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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

VOL. V.—1840.

WITH NUMEROUS ILLUSTRATIONS.

LONDON:

G. BERGER, HOLYWELL STREET, STRAND;

AND ALL BOOKSELLERS.

PREFACE.

At the conclusion of each successive volume of "The Mechanic and Chemist," it has been our pleasing task to thank our numerous supporters for the gradual, but constant increase of patronage, with which our efforts have been rewarded. The extensive circulation which this work has now attained, imparts to it a new and more important character; from merely recording and commenting on passing events, we may now claim a share in the power of directing them; for at no period did the legitimate expression of public opinion, exercise more influence upon the legislature, than at the present day. The present equitable system of Postage we owe almost entirely to the energetic expression of public opinion, formed, in a great degree, by the press; and, without pretending to more importance than really belongs to us, we may say that we have contributed, not a little, to the triumph of that great measure; for our arguments and our exhortations were reproduced and discussed in the daily papers of the metropolis, and thence in the provincial papers throughout the kingdom. The measure we now intend most especially to strive for, is the total repeal of the present very oppressive Patent Laws, and the substitution of common-sense, secure, and *cheap* protection to all who are justly entitled to it.

The contents of this Volume are too various for analysis; but a perusal of the Index will show how much valuable information is comprised in so small a compass.

To borrow the language of royalty, "we continue to receive assurances of the friendly disposition of all foreign powers and allies;" and we feel grateful for the favourable notices of "The Mechanic," which have repeatedly appeared in a great many esteemed publications. The numerous talented writers who have favoured us with their valuable contributions, are

also entitled to our best thanks; and, we trust, that the ensuing Volume will be adorned with productions of equal research and merit.

If uncompromising sincerity, an ardent desire to promote the welfare of the productive classes, and constant endeavours to season instruction with amusement, are claims upon public favour, we may venture to rely upon a continuance of the distinguished support we have so long enjoyed; and with grateful acknowledgment of the favours of all our friends, we respectfully submit the Fifth Volume of "THE MECHANIC," and Second of the New Series, to the approbation of the public.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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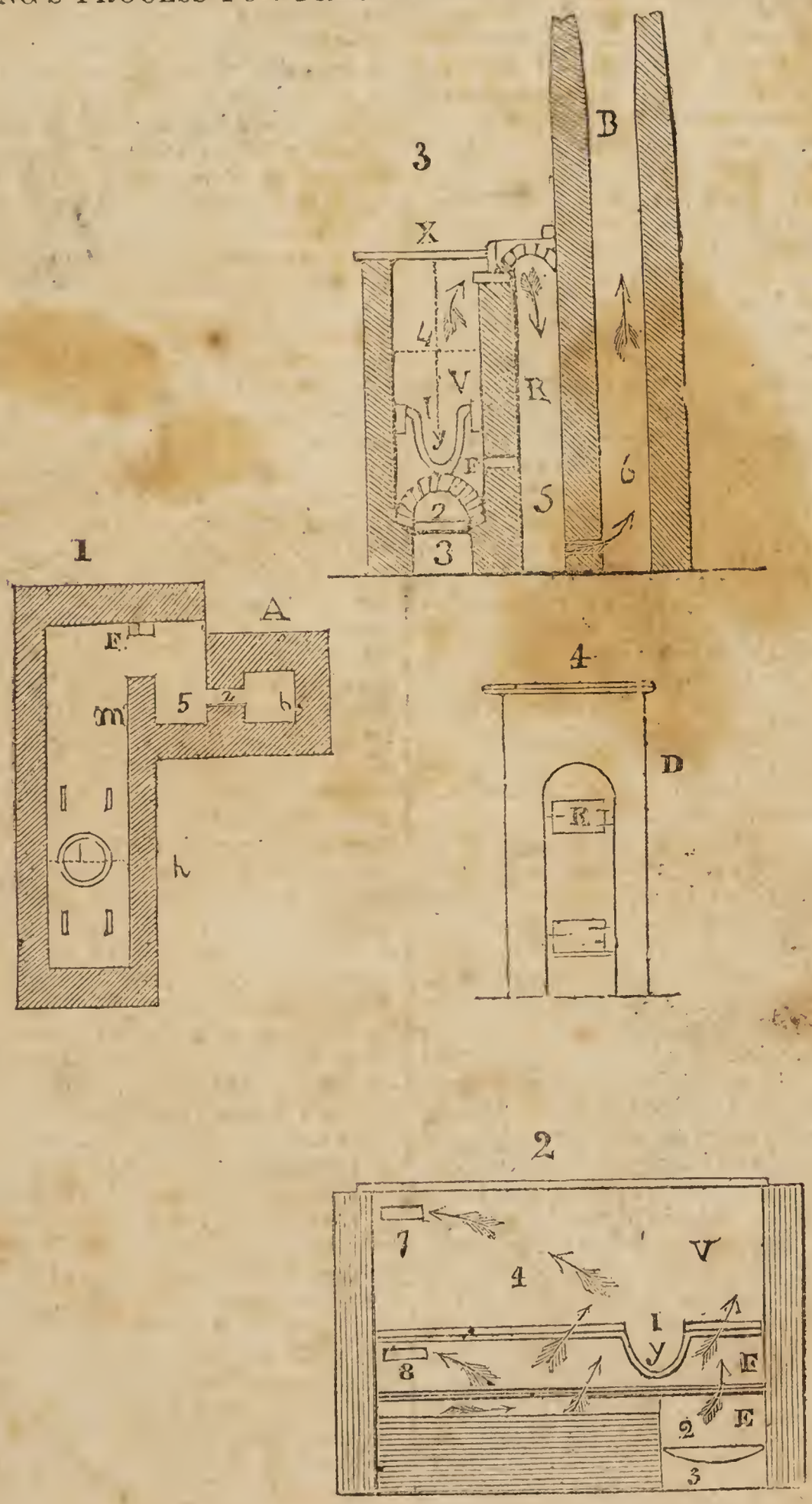
DOWLING'S PROCESS FOR PRESERVING METALS FROM OXIDATION



VOL. V.—Nos. 1 & 2.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

DOWLING'S PROCESS FOR PRESERVING METALS FROM OXIDATION.

Compiled from Specification of Patent.

(See engraving, front page.)

THE pieces of metal intended to be prepared, are to be first dry rough-ground upon a coarse grinding stone, such as are commonly used for grinding the coarsest hardwares; the grinding will be completed when every part of the surface of the metal has received a rough polish.

The pieces, when so ground, are to be immediately put into a conservative bath, in which they are to remain not less than forty-eight hours, after which time they may be taken out as they are wanted for continuing the process of preparation. This bath is composed as follows: Into a suitable vessel put 120 gallons of soft or rain water, to which add 120 pounds of soda of commerce, thirty pounds of chalk or very good quick-lime, and one gallon of pure olive oil; these ingredients are to be well stirred up together, and in twenty-four hours after, the bath will be fit for use, and the pieces of ground metal may then be put into it, but great care must be had not to let them touch each other, and the liquid ought to be kept as quiet as possible. When the articles are taken out of this bath, they are to be placed in the sunshine, or in any warm place, to dry quickly, but on no account are they to be rubbed for the purpose of drying them.

The next process to which the metals are subjected Mr. Dowling calls "Operating," and it is described as follows:—

The process of operating, is the rubbing of the ground or rough-polished surfaces of the metals, either in a hot or cold state, with zinc, until they have acquired a soft smooth face and zincky appearance, which is perceptible to the touch as well as to the eye. The better to effect this in a superior manner, as well as with economy, certain machines and tools are required; the principle machines used for this purpose are called operating zinc wheels. These wheels may be made of any diameter and breadth, and they may be constructed of any suitable material; they are to be fixed upon the axles in the ordinary manner, and made to revolve in framings sufficiently strong to resist the required speeds. The whole or parts of the circumference of these wheels is or are to be covered with zinc. These wheels require to be perfectly cylindrical, which is easily accomplished by turning them true upon the bearings in which they are to operate. The speed of these wheels varies according to the nature of the work, but Mr. Dowling recommends three wheels employed in succession; the first wheel revolves at the rate of 1200 feet at the circumference, per minute; the second wheel revolves 2000 feet per minute; and the third wheel revolves 4000 feet per minute; but it is not necessary that these exact velocities should be adhered to. The workmen are protected by strong wooden guards, from accident, in case the wheel breaks whilst working at these high speeds. The pieces under operation are held against the wheels, and pressed thereon, more or less, as may be practicable or necessary. The pieces of metal to be operated upon are first submitted to the slowest wheel, and to be finished with the wheel of quickest speed. In preparing pieces of copper or iron which have curvelinear and angular forms, and which cannot be submitted to the circular action of the grinding stones and the operating zinc wheels, the grinding is to be replaced by rasp or very rough filing, and the process of operating is to be done by hand with zinckers, which are tools made of zinc, and which tools are of various forms and sizes to suit the corners and angles of the pieces to be operated upon. The operation of zincking with these zinckers, is simply rubbing, as hard as possible, upon the surface of the metals which have been rasped or rough filed, with the tool or zincker, in the manner of filing until the said surfaces have acquired the appearances before named. In operating upon very large plates of metal, such as boiler plates, plates for large vats or brewing coppers, &c., heavy pieces of zinc called lumps, are employed, and the process of operating with them is by moving them backwards and forwards upon the surface of the plates by an alternate movement. During the process of operating, whether with operating zinc wheels, the zinckers, or the lumps, it will be advantageous from time to time to throw on the surface of the metal under operation a little finely-powdered sal-ammoniac; when the pieces of metal have got a sufficient dose of zinc in the process of operating, they are to be taken to the galvanic-vapour furnace, for the purpose of undergoing the galvanic process, the construction of which, as well as the manner of working it, is thus described:

In the engravings, figs. 1, 2, 3, 4, are shown—first, a sectional plan; second, two vertical sections; third, an end view of the said galvanic furnance. It is composed of a heating furnace, with grate-bars F, vapour galvanic furnace, V, with crucible, J, condensing flue, H. The

figures of reference are as follows :—
No. 1 is a crucible made of refractory or fire clay, in the manner and of similar materials as the crucibles used by glass-blowers.

No. 2 is the heating furnace, with grate bars furnace.

No. 3 is the ash-hole.

No. 4 is the galvanic furnace.

No. 5 is the condensing flue.

No. 6 is the chimney.

No. 7 is a small flue with a damper, which communicates with the galvanic vapour furnace, V, and the condensing furnace, H.

No. 8 is another small flue with a damper, which communicates between the heating furnace and the condensing flue. The flue, No. 8, is to be used only when the fire in the furnace has been nearly lighted; afterwards, when the galvanic vapour-furnace has acquired a heat sufficient to melt lead, then the damper in the flue, No. 8, is to be closed, and the damper in the flue, No. 7, is to be opened.

No. 9 is a flue and damper, communicating with the chimney which is kept open or shut, as circumstances may require, and which can be judged only by the person who has acquired some experience in directing the process. In the furnace, F, an arch is built over the whole length and width of the grate-bars, and the heat is communicated first to the bottom and sides of the crucible, and afterwards passes into the vapour-furnace by the small flue, No. 10; without the interposition of the arch, the crucible would be broken by the direct contact of the flame.

The manner of working this galvanic furnace is as follows :—In the first place, the pieces of metal which have undergone the process of operating, are to be carefully placed in the vapour-furnace, V, and in the condensing flue, H, so as not to touch each other. The pieces are to be introduced through the iron doors, of which a suitable number must be made in the ends and sides of the said flue and furnace. When the furnace and flue are charged with the desired quantity of pieces of metal, the doors are to be carefully closed and luted, to prevent the vapour from coming out during the process. Before closing the vapour-furnace, 100 pounds of zinc must be put into the crucible, J, through the door, R, seen in the front elevation, fig. 4. A fire is now to be lighted in the furnace, F, and the damper, No. 8, is to be opened, and must remain open until the galvanic-vapour furnace has acquired a heat sufficient to melt lead, when the damper is to be closed, and that of No. 7, is to be opened, and kept open till the end of the process, which now in reality commences, and the heat of the furnace must be inward, so as to cause the zinc to burn or deflagrate, and this heat must be kept up during four hours; the fire is then allowed to go out, and the damper of the chimney to be closed, when the process will be finished, the greater or less success of which will depend upon the attention paid to the fires, which ought to be kept up with great regularity, communicating with the chimney during the process, and from time to time it will be of advantage to put a small quantity of green or fresh-cut wood, or bark, into the furnace, F. It will have succeeded satisfactorily if the metal have assumed a dull bluish colour, resembling laminated zinc. The furnace must be kept to cool, after which it is to be opened, and the pieces of metal taken out, and the sublimated zinc, which adheres about the furnace, and more particularly about the walls of the condensing flue, are to be carefully collected. The pieces of metal, as soon as taken out of the furnace, may be covered with a thick coating of good paint or varnish of any required colour.

OPTICAL INSTRUMENTS.

NO. III.

ON SINGLE AND COMPOUND LENSES.

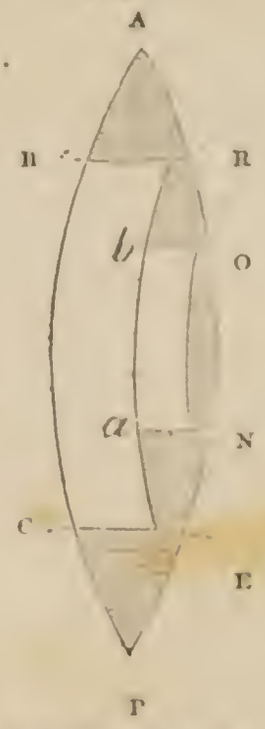
SPECTACLES and reading glasses are among the simplest and most useful of optical instruments. In order to enable a person who has imperfect vision to see small objects distinctly, when they are not far from the eye, such as small manuscript, or a small type, a convex lens of very short focus must be used, both by those who are long and short-sighted. When a short-sighted person, who cannot see well at a distance, wishes to have distinct vision at any particular distance, he must use a concave lens, whose focal length will be found thus :—Multiply the distance at which he sees objects most distinctly, by the distance at which he wishes to see them distinctly with a concave lens, and divide this product by the difference of the above distances. A long-sighted person, who cannot see near objects distinctly, must use a convex lens, whose focal length is found by the preceding rule. In choosing spectacles, however, the best way is to select, out of a number, those which are found to answer best the purposes for which they are particularly intended.

Dr. Wollaston introduced a new kind of spectacles, called *periscopic*, from their

property of giving a wider field of distinct vision than the common ones. The lenses used for this purpose are meniscuses, in which the convexity predominates for long-sighted persons, and concavo-convex lenses, in which the concavity predominates, for short-sighted persons. Convex lenses possess peculiar advantages for concentrating the sun's rays, and for conveying to an immense distance a condensed and parallel beam of light.

M. Buffon found that a convex lens, with a long focal length was preferable to one of a short focal length, for fusing metals by the concentration of the sun's rays. A lens, for example, 32 inches in diameter, and six inches in focal length, with the diameter of its focus eight lines, melted copper in less than a minute; while a small lens, 32 lines in diameter, with a focal length of six lines, and its focus two-thirds of a line, was scarcely capable of heating copper. The most perfect burning lens ever constructed, was executed by Mr. Parker, of Fleet-street, at an expense of 700*l*. It was made of flint-glass, was three feet in diameter, and weighed 212 pounds. It was $3\frac{1}{4}$ inches thick at the centre; the focal distance was six feet eight inches, and the diameter of the sun in its focus one inch. The rays refracted by the lens were received on a second lens, in whose focus the objects to be fused were placed. This second lens had an exposed diameter of 13 inches; its central thickness was $1\frac{3}{8}$ of an inch; the length of its focus was 29 inches. The diameter of the focal image was three-eighths of an inch. Its weight was 21 pounds. The combined focal length of the two lenses was five feet three inches, and the diameter of the focal image half an inch. By means of this powerful lens, platina, gold, silver, copper, tin, flint, quartz, agate, &c., were melted in a few seconds. Various causes have prevented opticians from constructing burning lenses of greater magnitude than that made by Mr. Parker. The impossibility of procuring pure flint glass tolerably free of veins and impurities for a large solid lens; the trouble and expense of casting it into a lenticular form without flaws and impurities; the great increase of central thickness, which becomes necessary by increasing the diameter of the lens; the enormous obstruction that is thus opposed to the transmission of the solar rays, and the increased aberration which dissipates the rays at the focal point, are insuperable obstacles to the construction of solid lenses of any considerable size. In order to improve a solid lens formed of one piece of glass, whose section is A B C P N O A, Buffon proposed to cut out all the glass left white in the figures, viz., the portions between B C, in fig. 1, and *a b*, and between *a b* and the left-hand surface of O N. A lens thus constructed, would be incomparably superior to the solid one, A B C P N O A; but such a process would be impracticable on a large scale, from the extreme difficulty of polishing the surfaces A B, C P, B *b*, P *a*, and the left-hand surface of N O; and even if it were practicable, the greatest imperfections in the glass might happen to occur in the parts which are left.

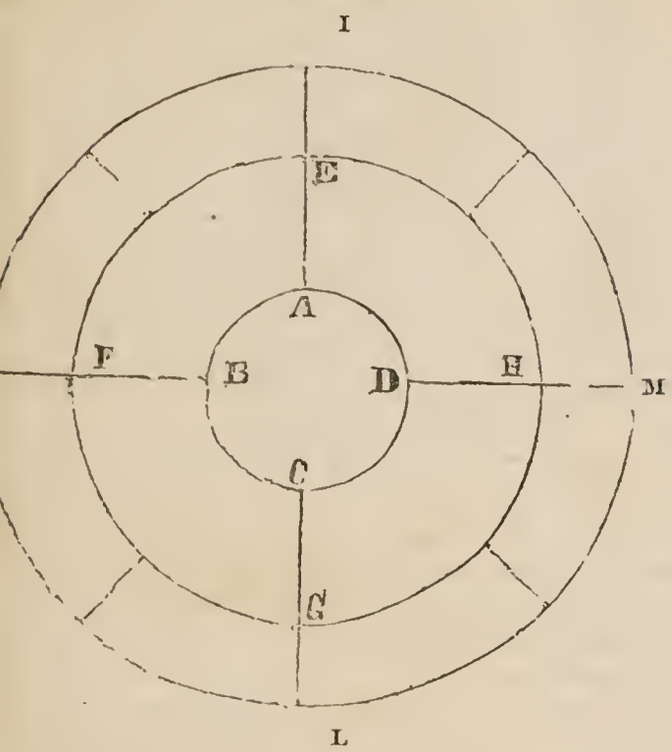
Fig. 1.



In order to remove these imperfections, and to construct lenses of any size, Dr. Brewster proposed, in 1811, to build them up of separate zones, each of which was again to be composed of separate segments, as shown in fig. 2. This lens is composed of one central lens, A B C D, corresponding with its section, N O, in fig. 1, of a middle ring, L F G H, corresponding to B O N E, in fig. 1, and consisting of five segments, and another ring, I K L M, corresponding to A B E P, and consisting of eight segments. The preceding construction obviously puts it in our power to execute these compound lenses of pure flint glass, free from veins; but it gives another great advantage, namely, that of enabling us to correct very nearly, the spherical aberration, by making the foci of each zone coincide. One of these lenses was constructed under Dr. Brewster's direction, for the Commissioners of Northern Lighthouses, by Messrs. W. and P. Gilbert. It was made of pure flint glass, and three feet in diameter, and consisted of many zones and segments. Lenses of this kind have been made in

France of crown glass, and have been introduced into the principal French lighthouses; a purpose to which they are infi-

Fig. 2.



nitely more adapted than the best constructed parabolic reflectors made of metal. A polyzonal lens of at least four feet in diameter, has been executed as a burning glass.

A. D. M.

INSTITUTION OF CIVIL ENGINEERS.

ABSTRACT OF PROCEEDINGS ON RAILWAYS.

Session, 1839.

"On Tubing the Boilers of Locomotive Engines." By George Buck, M. Inst. C. E.

In this communication, the author has attempted to determine the diameter of the tubes of the boiler of a locomotive engine, so that the effect in the generation of steam may be a maximum. The following are the conditions upon which the problem is solved:—That the evaporating effect of the hot air, in passing through the tubes, is in proportion to the extent of surface in contact with the hot air, and as the time of contact conjointly. The following are the results of the investigation:—The distance between the centres of two adjacent tubes should be equal to four times the interval between their internal surfaces—the diameter of each tube should be equal to three times the same interval—that the tubes should be as near each other as possible.

In illustration, Mr. Buck has drawn two sets of tubes of the locomotive boiler as generally employed, and one as they would be arranged according to the results of this investigation. On comparing the products of the aggregate periphery, and the aggregate area of the tubes, it appears that the boiler, tubed according the above theoretic proportion, is from 23 to 26 per cent. superior to the others.

"Manchester and Leeds Railway Section." By Francis Whishaw, M. Inst. C. E.

This section, prepared under the direction of Mr. Wishaw, is designed to afford a novel and useful method of embodying a great mass of the details required by an engineer when giving evidence before a Parliamentary Committee. This section was constructed before the last Standing Orders, and the author had here anticipated them in putting upon this section much of the detail now required. By sections thus prepared, the engineer can always answer any questions which may be put to him.

"On the comparison between the power of Locomotive Engines and the effectproduced by that power at different Velocities." By Professor Barlow, Hon. M. Inst. C.E.

In this communication the author attempts to lay down an appropriate method for computing the power of locomotive engines; and though this method will not serve to exhibit the absolute power of the engines, it may serve to exhibit the comparative power under different conditions. We know the number of cubic feet of water evaporated in any given time; the diameter of the driving wheels, the length of stroke, and the capacity of the cylinder; we hence know how many cubic feet of steam have been employed, and consequently the mean number of cubic feet of steam produced from one cubic foot of water. Again, by experiments that have been made by different writers upon the elastic force of steam, we know the pressure per inch on the piston, and then making due allowance for the resistance of the atmosphere on the piston, the friction of the engine gear, &c., there remains the force that ought to be effective on the piston. This being reduced to the circumference of the wheel, should be equal to the resistance opposed by the load, which on a level plane consists of axle friction, road resistance, and the resistance of the atmosphere to the engine and carriages. But this is assuming that the engine has a perfect action, without any waste, which,

however much to be desired, can never be the case in practice. Thus, comparing what ought to be done in overcoming resistance with what is done, we shall learn the amount of power wastefully expended.

The author then selects some experiments from those made on the North Star and Varvey Coombe engines, as reported by Mr. Wood to the Directors of the Great Western Railway, and illustrates by these the proposed method, and exhibits the results in tables.

From one of these experiments it appears, that the steam power expended per ton of the gross load amounts to 32 lbs, whereas on a tolerably level line it is generally assumed, that the retardation of such a load does not amount to more than 9 lbs. per ton; so that there appears to have been a power expended more than three times as great as the mechanical resistance to which it was opposed, according to views hitherto taken on the subject.

The author then proceeds to consider the resistance to railway trains at different speeds, and these resistances he refers to, 1st. That of the atmosphere; 2nd. The friction of the axles; 3rd. The road resistance. He discusses several experiments made by Mr. Wood, and remarks on the great discrepancies which they present—the atmospheric resistance in one case amounting to 353 lbs. and in another to 99.7 lbs. at the same velocity, viz., 32½ miles per hour; the friction in the former case being 5 or 6 lbs., and in the latter 20 lbs. per ton. The results of the best experiments on the atmospheric resistance and on friction, show that the former must be considered to vary nearly as the square of the velocity, and the latter to be constant, or independent of the velocity; but this law of the constancy of friction, owing to the peculiar circumstances of the case, cannot hold with respect to the axles of railway trains.

Very much must be attributed to the increase of the road resistance as due to the deflection of the rails at high velocities, and to the state of oscillation to which all the parts of the carriages are subject, and the imperfection of the joints. The author proceeds to make some observations on the actual state of our knowledge with respect to the atmospheric resistance, and the effect of inclined planes on the working of a line of railway. The speed in descending planes is limited by considerations of safety, and in planes of 1-96, 1-100, and 1-220; it is not safe to descend with heavy loads at a greater mean rate than is attainable with the same load on a level; that on planes between 1-750, and a level, the whole attainable speed is admissible.

The method of inferring the power of an engine from the quantity of water evaporated, was objected to on the grounds that so much water is lost by priming.

With respect to the resistance due to the imperfection of the joints, it was remarked that engineers are generally so much restricted as to the expense of making the joints of rails, they cannot adopt that which is the best; and it is a question well worthy of attention, whether the best kind of joint is not the most economical, as the wear and tear would be diminished, and the comfort of the passengers increased, by attention to this point.

The experience of the Dublin and Kingstown Railway showed that great advantages would result from a better kind of joint being used. This railway, though so short, and only having been finished about three years, has had, perhaps, more frequent traversings than a longer railway would in fifteen years; the trains started every half hour, and frequently the departures were increased to every quarter of an hour; the opportunities of observing the effect of the carriages upon the rails were, therefore, excellent.

"Description of an instrument for setting out the width of cuttings and embankments of Railways, Canals, or Roads, as particularly applicable to falling or side-lying ground." By Henry Carr, Grad. Inst. C. E.

The object of this instrument is to facilitate the operation of determining the distance of the outer lockspit from the centre line of a cutting or embankment, by avoiding all calculation, and reducing the usual threefold operation into one. The principle of its construction is the formation of a half cross section, which may be easily altered to suit all cases with regard to base, side slope, and inclination of surface. The construction of the instrument is described in great detail by reference to the drawing accompanying the communication. The author states, that he set out a portion of the South Eastern Railway with this instrument, and found it answer exceedingly well. The experience of the first instrument has suggested some improvement in its construction, which is represented in another drawing.

"Observations on the present mode of executing Railways, with suggestions for a more economical, yet equally efficient sys-

tem, of both executing and working them." By Francis Wishaw, M. Inst. C.E.

The author at the commencement of this paper, alludes to the principal causes of the great differences between the original estimate and cost of railways. Among these he enumerates the imperfect knowledge of the strata, which occasions the cuttings and embankments to be formed with slopes, which are dangerous, and add to their cost—the imperfect formation of the embankments, especially in clayey soils, which, in the opinion of the author, ought to be carried up in layers or courses of from 1½ to 2 yards in thickness, sufficient time being allowed for subsidence before the next layer is added—the cost of stations, which in some of the great lines forms a considerable proportion of the whole cost.

The author then proceeds to suggest means for effecting a considerable saving in the original cost of railways, a certain method of preventing accidents by collision, a saving in the annual expenditure, and a better adaptation of the locomotive engine to its work.

With these views he proposes a single line of rails, that the line should be divided with intermediate engine stations, three on the London and Birmingham, for instance, the engines at each being suited to the prevailing gradient of the district. Thus a line of railway may be more easily laid out, as one or two unfavourable inclines will not affect the working of the whole. At each station there must be a small portion of an additional line of rails, and also at other convenient intervals. The mode of working such a line is as follows:—Engines are to start simultaneously in each direction from the terminal and intermediate stations. These engines will pass each other at one of the portions of the double line, and the engine being reversed and taking the other train, will return to the station from whence it started, when another exchange of trains takes place. Thus there is a regular interchange of loads throughout the day, and each engine is confined to its own portion of the line, and it is impossible that a collision can take place. Equal accommodation would be afforded to the public, and the engine-man, from being always confined to the same small portion of the line, would be perfectly conversant with every part of it. The saving which would on this system be effected, on the original cost, is estimated at more than 5000*l.* per mile.

The attention of the meeting having been called to M. D. Harcourt's artificial granite for railways, blocks, and other purposes, Mr. Rastrick remarked, that he had about a month ago laid down blocks of the Scotch Asphalte, two feet square, on a portion of the Southampton Railway. The sleeper was put in while the block was formed. It was usual to bore holes and to fix the chairs by bolts. He had wished to ascertain how far the blocks would stand the driving in of the bolts, without any boring; they bore this without any apparent injury, and he thought these blocks, weighing about 3¾ cwt., would answer the purpose better than blocks of other materials.—*Railway Times.*

THE GALVANIC TELEGRAPH AT THE GREAT WESTERN RAILWAY.

The space occupied by the case containing the machinery (which simply stands upon a table, and can be removed at pleasure to any part of the room) is little more than that required for a gentleman's hat-box. The telegraph is worked by merely pressing small brass keys (similar to those on a keyed bugle) which acting by means of galvanic power, upon various hands placed upon a dial-plate at the other end of the telegraphic line, as far as now opened, point not only to each letter of the alphabet (as each key may be struck or pressed), but the numericals are indicated by the same means, as well as the various points, from a comma to a colon, with notes of admiration and interjection. There is likewise a cross (X) upon the dial, which indicates that when this key is struck, a mistake has been made in some part of the sentence telegraphed, and that an "erasure" is intended. A question—such, for instance, as the following:—"How many passengers started from Drayton by the ten o'clock train?" and the answer could be transmitted from the terminus to Drayton and back in less than two minutes. This was proved on Saturday. This mode of communication is only completed as far as the West Drayton station, which is about 13½ miles from Paddington. There are wires (as may be imagined) communicating with each end, thus far completed, passing through a hollow iron tube, not more than an inch and a half in diameter, which is fixed about six inches above the ground, running parallel with the railway, and about two or three feet distant from it. It is the intention of the Great Western Railway Company to carry the tube along the line as fast as completion of the rails takes place,

and [illegible]ly throughout the whole distance to [illegible]tol. The machinery and the mode of [illegible]king it are so exceedingly simple, that a child who could read would, after an hour or two's instruction, be enabled efficiently to transmit and receive information.—*Observer.*

WRECK OF THE ROYAL GEORGE.

So much interest has been excited by the recent experiments of Colonel Pasley, that we are induced to give our readers an account, collected from the publications of the day, of the loss of the *Royal George*, and some subsequent attempts to recover her. It may be proper to explain that the process of careening is performed by removing the guns, or other heavy bodies, to one side of the ship, so that the opposite side rises out of the water. In the summer of 1782, it was found necessary that the *Royal George*, of 108 guns, commanded by the gallant Admiral Kempenfeldt, and long held as the first ship in the British navy, should receive a sort of slight careen, which the seamen, in their peculiar phraseology, call a *parliament heel:* the ship having to be laid, in a certain degree, upon her side, while the defects under water, which occasion the examination, are rectified. This seems to be a common operation where the defects are not so great as to require a thorough careen; or where the delay, as in the present instance, of going into dock cannot be allowed; and being usually practiced in still weather and smooth water, is supposed to be attended with so little difficulty or danger, that the admiral, captain, officers, and crew, all continued on board, and neither guns, stores, water, or provisions were removed. This business was undertaken betimes in the morning, a gang of carpenters from the Dock attending to assist; and it is said, that finding it necessary to strip off more of her sheathing than was at first expected, their eagerness to come at the leak, induced them to heel her a strake more upon her side than had been intended, and than possibly the commanders knew. The ship, as is usually the case upon coming into port, was crowded with people from the shore; particularly women, who were not estimated at less than 300. Among these were many of the wives and children of the seamen and petty officers, who, knowing the fleet was to sail upon distant perilous service, eagerly embraced the opportunity of coming to see their husbands and fathers. Between eight and nine hundred of the crew of the *Royal George*, including marines, were then on board.

In this situation, about ten in the morning, the admiral being writing in his cabin, and much the greater part of the people being then between decks, a sudden and unexpected squall of wind threw the ship fatally upon her side, and her gun-ports being open, and the motion of the cannon probably increasing the violence of the shock, she almost instantly filled with water, and went to the bottom. A victualler which lay alongside the *Royal George*, was swallowed up in the whirlpool, which the sudden plunge of so vast a body in the water occasioned; and several small craft, though at some moderate distance, were in the most imminent danger.

The admiral, with a number of brave officers, and, in general, most of those who were between decks, perished. The guard, including those who happened to be along with them, on the upper deck, were more fortunate; the greater part being saved by the boats of the fleet. About seventy others were likewise saved. The exact number of people on board at the time could not be ascertained, but it was supposed that from 900 to 1000 were lost. Something about 300, mostly, if not entirely, of the ship's company, were saved. Captain Waghorne, whose gallantry in the North Sea battle, under Admiral Parker, had procured him the command of the ship, had the fortune, though severely battered and bruised, to be saved; but his son, a lieutenant of the *Royal George*, happening to be one of those who were unfortunately below, perished.

Such was the fate of the *Royal George*, which carried the tallest masts, the heaviest metal, and had the greatest number of flags hoisted in her, of any ship in the British navy. She had been repeatedly the seat of command under almost all our great commanders, and upon the greatest occasions during the existing and previous war; and had been peculiarly distinguished under Lord Hawke, in the celebrated battle against M. Conflans, when the French fleet was entirely ruined; and she sunk the *Superbe*, of 70 guns, by a single broadside, and drove the *Soleil Royal*, of 84 guns, on shore, where she was burnt. The loss of the ship, notwithstanding the critical period at which it happened, would not however have been much thought of, if it had not been for the brave men who perished so unfortunately in her. Admiral Kempenfeldt, though near seventy years of age, was peculiarly and universally lamented. He was held, both abroad and

at home, to be, in point of professional science, experience, and judgment, one of the first naval officers in the world; particularly in the art of manœuvring a fleet, in which he was considered by our greatest commanders as unrivalled; and his excellent qualities as a man at least equalled his professional merits as an officer.

A large sum of money, which did honour to the feelings of the public, was immediately raised by subscription in London, for the relief of widows, children, and other depending relations, of those who had perished by this fatal accident. On the following year an elegant monument was erected, in the church-yard of Portsea, with an appropriate inscription, recording the fatal event which so suddenly deprived the nation of a great commander and so many of his brave companions. In 1783 an attempt was made to bring up the wreck; but without success, though the sloop, which was sunk with the *Royal George*, and lay close alongside her, was raised six fathoms from the bottom, and towed a considerable distance.

In 1817 the first survey was made by means of a diving bell. The *Royal George* was found lying nearly east and west, with her head to the westward, and with a trifling inclination on her larboard bilge. The whole of her decks had fallen in, and the starboard broadside upon them; there was, in fact, no appearance whatever of her original formation, her remains appearing as a pile of ruinous timber-work. The surface of her timbers was decayed, but the heart of them was sound. Not the least vestige of her guns, anchors, spars, or masts was discovered, and the whole of her head and rail-work had gone to pieces; the guns were supposed to have fallen into the hull, among the wreck. There was no bank or great accumulation of mud around her; the hollows in her hull contained a quantity of fine black mucose mud, the natural sediment of the tides. It was considered that she might, without much difficulty, have been sawn into pieces, or blown up; but not raised in a body, owing to her ruinous and unconnected state.

We learn with great satisfaction that Colonel Pasley, with the usual success which attends well-directed perseverance, has at length succeeded in firing off one of his enormous sub-marine mines of gunpowder against the wreck of the *Royal George* at Spithead. At two o'clock on Monday afternoon, as we learn from our Portsmouth correspondent, a cylinder, containing 3,320 lb. of powder, was carefully lowered to the bottom, where it was placed alongside the most compact portion of the wreck which has yet been discovered by the divers. This operation was effected by means of hauling lines rove through blocks attached to the bottom of the ships by the divers. When everything was ready, the vessel in which the voltaic battery was placed, was drawn off to the distance of 500 feet, which is the length of the connecting wires, and instantaneously on the circuit being completed, the explosion took place, and the effects were very remarkable. At first the surface of the sea, which had before been perfectly smooth and calm, was violently agitated by a sort of tremulous motion, which threw it into small irregular waves, a few inches only in height. This lasted for three or four seconds, when a huge dome of water made its appearance, of a conical or rather bee hive shape. At first it appeared to rise slowly, but rapidly increased in height and size till it reached the altitude of 28 or 30 feet, in a tolerably compact mass. It then fell down and produced a series of rings, which spread in all directions. The first, or outer one of these, having the aspect of a wave several feet in hight, curled and broke, as if it had been driven towards the shore. Neither the shock nor the sound was so great as had been expected by those who had witnessed the former explosions by Col. Pasley, where the quantity of powder was only 45lb.; but the effect produced on the water at the surface, considering that the depth was ninety feet, was truly astonishing. What the effect has been upon the wreck will not be fully ascertained by the divers till the present spring tides are over, and the long periods of slack water at the neaps enable the divers to remain for upwards of half an hour under water. In the mean time, it is highly satisfactory to know that Colonel Pasley has completely established his command over the application of the voltaic battery to submarine purposes, and that he can now with certainty explode his charges at any depth of water. This will give him the power of placing his cylinders against the most refractory parts of the wreck, and, by blowing these to pieces, and dislocating the knees, timbers, and beams, enable him to draw the whole up, bit by bit, to the surface. Any person who has seen the operation of breaking up a ship on land, knows that this is the only way of going to work with a mass so firmly bound together as a line-of-battle-ship, that even the action of fifty-seven years of decay

under water goes but a small way to disintegrate the parts. The manly perseverance of Colonel Pasley, therefore, we are well convinced, will, in the end, effectually clear the noble anchorage of Spithead of this extremely troublesome obstruction. —*Times.*

INFLUENCE OF COLOUR ON ODOURS.

The attention of Dr. Stark was first directed to the subject of odours, as connected with colour (during his attendance at the anatomical rooms in the winter session), from the following circumstance: Happening one day to attend the rooms in black clothes, he was not a little struck by the almost intolerable smell they had acquired; it was so strong, as to be remarked by the family, and was recognised on the same dress for several days; but no odour to the same extent had been remarked in the lighter-coloured clothes: slight exposure to the air alone was necessary to deprive them of the odour which they had thus contracted. This circumstance induced him to begin a series of experiments, to ascertain, if possible, why different clothes of nearly the same texture, but not of the same colour, should attract odours in proportions so different. The result was, as he conjectured, that the colour of bodies, independent of the nature of the substances, modifies in a striking manner the capability of surfaces for imbibing and giving out odours. He then enclosed six different coloured wools, an equal weight of each, viz., black, blue, green, red, yellow, and white, with assafœtida. They were ranged circularly round the odorous body, without touching it on one another, and were then covered over and excluded from the light. At the end of twenty-four hours they were examined. The black was found to have much the strongest smell of assafœtida; the blue the next; after that the red, and then the green: the yellow had but little smell, and the white scarcely any.

A similar experiment, using camphor instead of assafœtida, afforded precisely the same results.

Various coloured cottons were treated in the same manner. In all these the smell was invariably found to be of corresponding intensity, according to the colour, as in the wools. Silks of different colours gave the same results.

"It is proper to mention," says Dr. Stark, "that in most of these experiments I did not trust to my own olfactory organs alone. All the members of the family, and several of my friends, have lent their aid to distinguish between the different intensities of the odour which each substance had attracted; and though only a few experiments are here detailed, similar ones have been many times performed, with various other odorous substances. The whole of these in their general results seemed to establish the fact, that the colour of substances exerted a peculiar influence over the absorption of odours—[*Query.* May not the sickly disagreeable effluvium which is known to proceed from the skins of the negroes, to be in some way connected with this theory!]

"In all these experiments, however, reliance had to be placed upon one sense alone, viz., that of smell, as none of the substances employed had gained any appreciable weight. I was therefore desirous, that, if possible, at least one experiment should be devised, which would show, by the evidence of actual increase of weight, that one colour invariably attracted more of an odorous substance than another; and upon considering the various odorous substances which could be easily volatilized without change, and whose odour was inseparable from the substance, I fixed upon camphor as the one best suited to my purpose. In an experiment of this nature, it was necessary that the camphor should be volatilised, or converted into vapour, and that the coloured substances should be so placed as to come into contact with the camphor while in that state. It was therefore of the first importance to prevent currents of air within the vessel in which the experiment was conducted; and with this view I used a funnel-shaped vessel of tin plate, open at the top and bottom. This rested on a plate of sheet iron. In the centre of which the camphor to be volatilised was placed. The coloured substances, after being accurately weighed, were supported on a bent wire, and introduced through the upper aperture. This was then covered over with a plate of glass. Heat was now applied gently to volatilise the camphor; and when the heat was withdrawn, and the apparatus cool, the coloured substances were again accurately weighed, and the difference in weight noted down.

"Proceeding on this plan, I arrived at the most satisfactory and conclusive results. The deposition of the camphor in various proportions on the coloured substances submitted to experiment, offered evidence of the particular attraction of colours for odours, resting on ocular demonstration; and when to this is added

the evidence arising from a positive increase of weight, as ascertained by the balance, the conclusions previously drawn from the sense of smell are confirmed in a singular and very satisfactory manner." Dr. Stark proceeds to show, as the result of successive experiments, that "animal substances have a greater attraction for odours than vegetable matters, and that all these have their power much increased by their greater darkness or intensity of colour!"—also, "that the whole of the substances lose their sensible odour in nearly the same time, though the odorous particles given out by the black, were of course much greater in quantity than in the others."—*Phil. Trans.*

ALPHA.

PENNY POSTAGE.

To the Editor of the Mechanic and Chemist.

SIR,—As you have politely offered to receive any communications the readers of your useful publication may please to make on the subject of the new postage law, I beg leave to offer a few observations, not as an organization of a complete system, for that I cannot hope to accomplish; but if only a hint should be gathered therefrom by those who have the carrying into effect of this important measure, my object will be fully accomplished.

It appears to me, that the rate of postage throughout the kingdom should be uniformly that of a penny in the manner proposed, but left open to pay in advance or on delivery, for the following reasons: because it is more congenial to the present system and habits of the people; for as an experiment only, it is certainly too great a change to introduce a kind of forced prepayment, however small the amount; experience at the same time feels, that great and sudden changes, political and moral, are not always the best; therefore the change, in order to be durable, should be worked out gradually, for I am persuaded, if stamped envelopes alone are used, many letters will not be written at all, that would be, if left open for payment as now, especially amongst the poorer classes, and those situated in remote country places, where stamps could not be readily purchased; at any rate this would be the case for some time, until the system became general. Another thing, the stamped covers are evidently a partial monopoly, the least semblance of which should not enter into a scheme intended for the public good; next comes the liability of forging them. At first sight it may seem unlikely anyone would attempt forgery for so small an amount, but it must be seen that this system might be carried on in the wholesale style, and instead of a single sheet, quires and reams might be manufactured. It probably may be very difficult to imitate Mr. Dickenson's envelopes, but what one man has accomplished, another may; and what will not unprincipled persons do for the sake of gain? In spite of all protection against forgery and coining, it is yet nevertheless carried on to a frightful extent; and will not this plan open to all such a new field of action, and if once effected, the facility with which these false wrappers might be disposed of would be immense, to the great loss of the revenue, and probably the ruin of the whole business. This I hold as the strongest argument against the adoption of forced payment of stamps; but there is another: it is very evident, that until such a system were well known, and perhaps always, a great quantity of letters will be put into the Post-office, as usual, unstamped; these therefore, could not be forwarded, unless some provision were made for charging for them on delivery. This point seems worthy of consideration, or else it will produce much inconvenience and loss; and hence, it is plain, money transactions in the Post-office cannot be under these circumstances simultaneously abandoned. And after all, as the arrangements of this great and beneficial measure is vested in the hands of the Lords of the Treasury, stamped covers could be introduced; ultimately, should the voluntary system not be found to answer. Rowland Hill's plan, although excellent in principle, and will doubtless immortalize his name, proposes so great a revolution, that attempting to carry it all at once, will, I fear considerably endanger its success.

I remain yours, &c.

A SINCERE FRIEND TO THE MEASURE.

THE CHEMIST.

ACIDS.

NO. II.

BOLETIC ACID was obtained by Braconnet from the *boletus pseudo ignarius*, by evaporating its expressed juice to the thickness of syrup, digesting it in alcohol, dissolving the residue in water, and adding nitrate of lead to the aqueous solution; the precipitate washed and diffused through water, was decomposed by sulphuretted hydrogen; the liquor was then filtered and evaporated till it formed chrystals, which

were purified by solution in alcohol and evaporation. These chrystals are boletic acid; they are prismatic, and require 180 parts of water at 68°, and 45 of alcohol for their solution, which reddens blues and precipitates nitrate of lead, and the salts containing the peroxide, but not those of the protoxide of iron. This acid sublimes with little alteration when heated. It forms salts called *boletates*.

Bromic acid is obtained by the decomposition of a solution of bromate of haryta; by sulphuric acid, sulp' ate of baryta is precipitated, and a solution of bromic acid obtained, which may be concentrated by slow evaporation; at a high temperature it is partly decomposed, so that it cannot be obtained anhydrous. It is sour, inodorous, and first reddens, then destroys the blue of litmus. It is partially decomposed by sulphuric acid, but not by nitric acid. It is decomposed by sulphurous acid, by sulphuretted hydrogen, and by hydriodic and hydrochloric acids. Its salts are termed *bromates*.

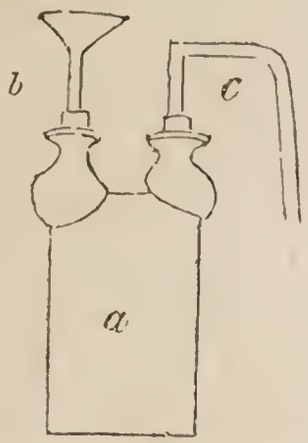
Boracic acid is obtained by dissolving the salt called *borax* in hot water, subsequently adding half its weight of sulphuric acid. As the solution cools, white scaly chrystals appear, which, when washed with cold water, are nearly tasteless, and consist of boracic acid, combined with about 40 per cent. of water, and retaining a little sulphuric acid, which it loses by exposure to a strong red heat, and fuses into a transparent hard glass. The specific gravity before fusion is 1.48; after fusion, about 1.8; at a white heat this acid slowly sublimes. Boracic acid is very difficultly soluble in water; boiling water takes up about one-fiftieth of its weight. The solution reddens vegetable blues, but possesses the singular property of rendering the yellow of turmeric brown, in the manner of an alkali. Boracid acid is partially decomposed by hydrogen at high temperatures, and by some of the metals. Its solution in spirit of wine burns with a green flame. Its salts are called *borates*.

Camphoric acid may be formed by triturating four ounces of camphor with a few drops of spirit of wine. It may be introduced into a two-quart tubulated retort, placed in a sand heat; pour upon it thirty ounces of common nitric acid, and proceed to slow distillation; when two-thirds of the acid has passed over, return it to the retort, and distil as before, repeating the operation twice more, after which, as the liquor cools, a quantity of crystals of camphoric acid are deposited, which are to be washed and dried. This acid assumes the form of plumose crystals, soluble in about 100 parts of water at 60°, and in rather more than one part of alcohol. Its taste is acid, and somewhat acrid, and it has an aromatic odour; exposed to heat, it sublimes unaltered. It combines with the solifiable bases, constituting a class of salts called *camphorates*.

Carbazotic acid may be thus obtained:—A portion of the best indigo is to be broken into small fragments, and moderately heated with eight or ten times its weight of nitric acid. It will dissolve, evolving an abundance of nitrous vapours, and swelling up in the vessel. After the scum has fallen, the liquid is to be boiled, and nitric acid added whilst any disengagement of red vapours is occasioned by it. When the liquid has become cold, a large quantity of semi-transparent yellow crystals will be formed, and if the operation has been well conducted, no artificial tannin or resin will be obtained. The crystals are to be washed with cold water, and then boiled in water sufficient to dissolve them, If any oily drops of tannin form on the surface of the solution, they must be carefully removed, by touching them with filtering paper; then filtering the fluid, and allowing it to cool, yellow brilliant crystalline plates will be obtained, which will not lose their lustre by washing. Sometimes crystals are not formed after the action of the nitric acid on the indigo, in which case the liquor must be evaporated, and water added, when the substance will precipitate, and must be purified as follows:—The precipitate must be dissolved in boiling water, and neutralized by carbonate of potash. Upon cooling, a salt of potash will chrystallize, which should be purified by repeated chrystallizations. The salt obtained in this operation is to be re-dissolved in boiling water, and nitric, muriatic, or sulphuric acid added; as the solution cools, this peculiar substance will be observed to form very brilliant plates, of a clear yellow colour, generally in equiliteral triangular forms. When the substance is heated it fuses, and is volatilized without decomposition; when subjected to a sudden strong heat it inflames, without explosion, its vaporous burning with a yellow flame and a carbonaceous residue remaining. It is but little soluble in cold water, but much more in boiling water; the solution has a bright yellow colour; reddns litmus has an extremely bitter taste, and acts like a strong acid on metalic oxides, dissolving them; ether and alcohol dissolve it readily. It forms a class of salts called *Carborsotates*.

Carbonic Acid may be procured by acting upon *carbonate of lime*, by dilute muriatic

acid, for this purpose :—The carbonate of lime is introduced into the two necked bottle, and covered with water ; muriatic acid is then slowly poured down the

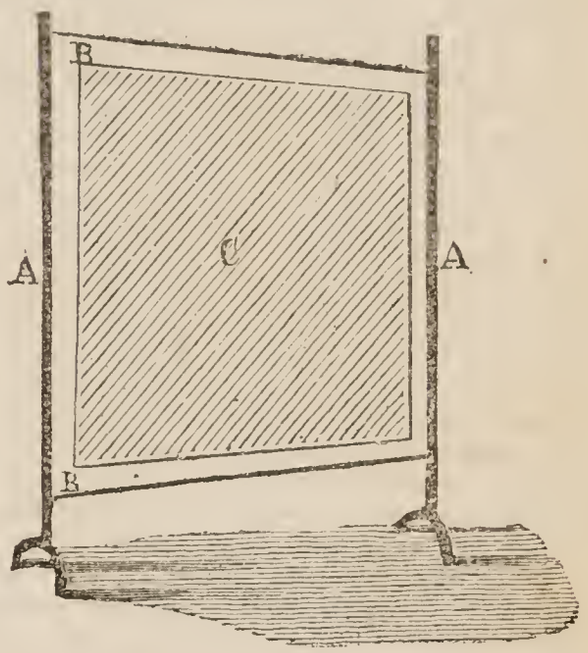


funnel b which causes an immediate effervescence, and the gas passes through the bent tube B, from whence it may be collected by the pneumatic trough. Carbonic acid may be collected over water, but must be preserved in vessels with glass stoppers, since water, at common temperature and pressure, takes up its own volume and acquires a specific gravity—1. 0015, under a pressure of two atmospheres twice its volume, and so on. It thus becomes brisk and tart, and reddens delicate vegetable blues. If litmus paper thus reddened be exposed to the air, the blue colour returns as the acid evaporates. Carbonic acid, though gaseous at all common temperatures and pressures, may be compressed into a liquid state. For this purpose, Mr. Faraday proceeded as follows. A strong tube, of about one fourth of an inch diameter and eight inches long, being bent at about two inches from its end, sulphuric acid was poured in through a small funnel so as not to soil the larger leg, which was then loosely filled with fragments of carbonate of ammonia ; it was then hermetically sealed, the acid was then made to run upon the salt, and the enclosed carbonic acid gradually appeared in the liquid form. *Liquid carbonic acid* is limpid, colourless, extremely fluid, and floats upon the other contents of the tube. By enclosing a guage in a tube in which fluid carbonic acid was afterwards produced, it was found that its vapour exerted a pressure of 36 atmospheres at a temperature of 32 deg. Carbonic acid is unrespirable, and when pure immediately suffocates an animal plunged into it. The weight may be shown by placing a lighted taper at the bottom of a tall glass jar, and then pouring the gas out of a bottle into it in the manner of a liquid ; it descends and extinguishes the flame, and will remain for some time in the lower part of the vessel. The miners call it *choak damp*. Carbonic acid retards the putrifaction of the greater number of animal substances applied to the roots of vegetables in a gaseous solution. Its production in the lungs is easily shown by blowing the expired air through lime-water, by means of a small tube ; it becomes milky, and soon deposits carbonate of lime ; with bases it forms a class of salts termed *Carbonates*. T. Mitchell.

SUBSTITUTE FOR A LEYDEN JAR.

To the Editor of the Mechanic and Chemist.

Sir,—Having paid a visit to the Gallery of Practical Science about a week since, I saw among the multiplicity of things there exhibited, a capital substitute for a Leyden jar, and I have sent you a cheap substitute for the same. B B, is a piece



of stiff card-board, supported by two insulated pillars, *a a*, on each side of which is pasted a square piece of tinfoil, C ; when charged, the person to whom the shock is to be given, must put his hands on both pieces of tin-foil, and the effect will be the same as with a Leyden jar.

Tyro Chemicus.

DISCOVERY OF FOSSIL REMAINS NEAR WOODBRIDGE, SUFFOLK.

(From the Ipswich Express.)

A discovery of fossil remains has been made at Kingston, near Woodbridge, which is likely to excite an extraordinary stir in the geological world. The jaw of a monkey, and that of an opossum, completely fossilised, have been obtained from a pit by the side of the Deben, where the clay is dug for the purpose of making bricks. Not only have the remains of these two animals hitherto been unknown to occur as fossils in this country, but the stratum in which they have been discovered, and which is geologically termed the

"London clay,' has previously not been supposed to contain any traces of fossil quadrupeds at all. At the meeting of the British Association, Birmingham, Mr. Lyell announced the discovery to the Geological Section, but the details form the subject of two papers in the "Magazine of Natural History" for the present month—one by Mr. Searles Wood, the late curator of the Geological Society, and formerly of Hasketon, Suffolk, who, in conjunction with Professor Owen, the celebrated comparative anatomist, describes the remains of the monkey, which appears to differ from any existing species of this tribe; and the other, relating to the opossum, is by the Editor of the Magazine, Mr. Edward Charlesworth. We extract from the Magazine Mr. Wood's letter:—

"No. 15, Bernard street, Aug. 21, 1839.

"Sir,—Hearing from Mr. Lloyd that a mammiferous tooth had been obtained by Mr. Wm. Colchester, from a clay-pit at Kingston, near Woodbridge, I was naturally desirous of visiting the spot, which I did, not without a slight hope of finding more, or at least of inducing a further search to be undertaken. The bed in which the tooth was found, lies immediately beneath a stratum of blue clay, which is used by Mr. Colchester in making bricks; but as the digging and working are only carried on during the winter, I was fearful that little could be done before that period. Hearing, however, from one of the men that a heap of sand, lying near the pit, had been thrown aside from those beds, I prevailed on Mr. Colchester, who was with me, to employ a boy to sift and search it, thinking it would probably yield something for the trouble, having myself, in the course of a few minutes, found several fishes' teeth upon the surface. I am happy to say, that I have since received a letter from Mr. Colchester, accompanied by a fossil; the specimen has been examined by Mr. Owen, who has kindly undertaken to give his opinion respecting it, in a paper to accompany the present communication. As this is the first notice of a quadrumanous (of the monkey tribe) animal having been found in England, it is of great importance correctly to ascertain the age of the bed to which it belongs; the fossil itself contains sufficient internal evidence to remove all doubt of its genuineness, as it had not the least appearance that a recent tooth would have assumed, conceiving such to have been accidentally introduced into the heap, even if Mr. Owen's determination of its extinct character was not a warrant for its originality. I received with it one or two fragments of bone, not yet satisfactorily identified; numerous fishes' teeth of the genus Lamna; and a specimen of Turbinolia. The teeth possess the sharpness of recent specimens, and were probably quietly deposited in their present locality, but the coral has undergone so much bouldering as to destroy its character and defy identification. The bed whence these remains were obtained, is a whitish sand beneath a stratum of tenacious blue clay, situated by the side of the river, about a mile from Woodbridge, in a parish commonly called Kyson. This clay may be traced beneath the crag not more than twenty yards from the pit, and is a continuation of the same bed which extends over a large portion of the eastern side of the county of Suffolk. Sections of this clay, with overlaying crag, may be seen at Sutton Bawdsey, Felixstow, &c., and although in all my searching for fossils, I have never been able to detect a single shell in the clay deposit, the Septaria, which are dredged up off Harwich, contain shells that have been identified with those of the London clay; and it is fair to assume that, as part of the bed connecting this clay at Felixstow and Walton-on-the-Naze, there is little doubt of its belonging to the eocene period, but at Kyson, which is one of the western limits of the crag, the beds become more irregular, and the shells are much comminuted, and at Hasketon, scarcely two miles further westward, the clay assumes a different character, being mixed with the detritus of the older rocks. I have there picked up shells of the Echini filled with chalk. The only doubt respecting the bed at Kingston would be, whether it could all belong to that extensive diluvial deposit which approaches so near. As this fossil certainly belongs to some quadrumanous animal, there is no formation to which it could be so appropriately assigned as that of the London clay—the tropical character of the Fauna, as well as of the Flora of that period, being such as to justify an assumption of a warmer climate, quite suitable to the existence of our Macacu. However, I have given you the particulars of its discovery, and I consign the details to abler hands.

I am yours, &c.

S. V. Wood."

MISCELLANEA.

Rival to the Daguerreotype.—If we believe the German papers, Leipmann, of Berlin, has invented a machine for obtaining correct copies of oil coloured pictures, which is not less ingenious than the Daguerreotype. For some years a little slender-made man, whose attire denoted poverty, was observed in the Museum of Berlin, where he was to be seen every week. Instead of walking through the galleries and examining the various paintings, he was always in the Flemish room, stationed before the same picture—a portrait of Rembrandt. He would remain there for hours together, his hands behind his back, and his eye fixed upon the picture. This was ascribed to eccentricity, whilst it was a serious and singular study, leading to a discovery which will form an era in the history of painting. M. Leipmann was meditating upon the invention of a machine for reproducing oil paintings, and, after ten years of persevering labour, he has succeeded beyond all expectation. At his residence are to be seen above a hundred copies of that head of Rembrant, all of them of scrupulous resemblance to one another. How he has achieved this, is his own secret. When one considers what privations he must have suffered in realizing his ideas, one cannot help wishing that his efforts may be rewarded. With the assistance of a trust-worthy maid-servant, he has laboured for many years night and day, making sealing-wax at night to procure a livelihood. The most surprising circumstance is, that he did not previously make a complete copy of the picture, but con-

veyed it home by parts as he had it in his mind after visiting the Museum. Thus, on one day it was an eye, on another the nose, on a third a lock of hair that he took home, which must have required whole years for the completion of his task. He has produced with his machine, in one of the rooms of the Royal Museum, and in presence of the Directors, 110 copies of Rembrandt's portrait, painted by himself—a picture, the copying of which in the usual way presents the utmost difficulties, according to the opinion of all painters. Leipmann's copies are said to be perfect, and to give the most delicate shades of the colour. He asks but a *louis d'or* for a copy. His invention excites universal admiration.

Electro-Magnetic Navigation.—Mr. Faraday has recently received a letter from H M. Jacobi, dated St. Petersburgh, on the application of electro-magnetism to navigation. The following is a short extract:—"In the application of electro-magnetism to the movement of machines, the most important obstacle always has been the embarrassment and difficult manipulation of the battery. The obstacle exists no longer. During the autumn of 1838, and at a season (in 1839) already too advanced, I made, as you will have learned by the *Gazettes*, the first experiments in navigation on the Neva, with a ten-oared shallop, furnished with paddle-wheels, which were put in motion by an electro-magnetic machine. Although we voyaged during entire days, and usually with ten or twelve persons on board, I was not satisfied with this first trial, for there were so many faults of construction, and want of insulation in the machines and battery, which could not be repaired on the spot, that I was terribly annoyed. All those repairs and important changes being accomplished, the experiments will shortly be recommenced. The experience of the past year, combined with the recent improvements of the battery, give as the result, that to produce the force of one-horse (steam-engine estimation), it will require a battery of twenty square feet of platina distributed in a convenient manner, but I hope that eight to ten square feet will produce the effect. If Heaven preserve my health, which is a little affected by continual labour, I hope that by next midsummer I shall have equipped an electro-magnetic vessel of from 40 to 50-horse power!"

Alpaca Wool.—At the late meeting of the British Association at Liverpool, samples were shown of a manufactured specimen of Alpaca Wool, resembling silk, being black as jet without dye, and more valuable in many of its qualities than sheep's wool. The animals producing it are of the Llama tribe, and, it is said, might with advantage be propagated by the agriculturists of the United Kingdom. The Alpaca is well suited to this country, but more particularly to Scotland and Wales, being an inhabitant of the Cordeleræ, a mountainous district in Peru, below the line of perpetual snow, about 160 miles in extent. They are nowhere else to be found in South America, either on the east or western coasts. Importations of the wool have already taken place to the extent of 1,000,000 lbs., which are likely to increase; and some of the animals are already in New South Wales. The Alpaca has fine wool, six to twelve inches long, as shown by the specimens exhibited. It is used as deer in the parks of the old Spanish grandees in Peru, and its flesh is eatable and equal to any venison. It has been propagated by the Earl of Derby in his menagerie at Knowsley, and there are a few specimens in the London and Liverpool Zoological Gardens. Their breeding here would not interfere with wool, but come more in competition with silk. The Alpaca should not be penned up in English parks or gardens, but left to range in the mountains, where it will find food congenial to its nature, not being susceptible of cold. It does not perspire as sheep do; the wool exhibits no animal grease, and is shipped just as when clipped. The animal, therefore, does not require the care and attention which sheep do in the Highlands of Scotland, to be loaded with tar and butter, to preserve them from death. The Alpaca wool is capable of the finest manufacture, and is especially suited to the fine shawl trade of Paisley, Glasgow, Edinburgh, &c. The yarns spun from it are already sent to France in great quantities, at from 6s. to 12s. 6d. per lb. The price of the raw Alpaca wool is now 2s. to 2s. 6d. per lb., and it is not likely to go below 1s. 6d. Mr. Dawson, Woolbroker, Liverpool, offers to furnish gratuitously, one or two pounds of the wool to any agriculturist, or any silk or woollen manufacturer, who feels interested in the matter, on application to him at Liverpool.

Doctor Turnbull's Successful Method of Treating Deafness.—In an age of empiricism like the present, we are inclined rather to commend than censure the caution of the public in receiving with diffidence the reported success of any man in the treatment of maladies, over which surgical skill has hitherto had but slight effect. It is now some time since we first heard of the extraordinary cures performed by Dr. Turnbull, of Russell-square; but though we heard and read well of his character as a physician, we deferred judgment until satisfied by the evidence of our own senses. We have within the past week witnessed this proof in the person of one born deaf and dumb, and to whom he has restored the faculty of hearing, and of articulation also. This, we are assured, is achieved by no surgical operation, nor is there any affectation of mystery about the treatment, which consists in the simple application of a certain fluid, no occult process—the only talisman is the Ephphatha, the "be ye opened" of skill and science, to whose triumphs Dr. Turnbull has eminently contributed. We think it right, more for the sake of society than this gentleman, who, however, may be deemed one of its best benefactors, to publish a fact, the announcement of which must give infinite pleasure to the friends of all those who may labour under the most distressing of all defects.—*Bristol Times.*

Shock of an Earthquake.—On Sunday morning last, between the hours of two and three o'clock, a severe shock of an earthquake was felt at Newport. The same shock was felt at Lantarnam, Caerleon, and neighbourhood. It was so severe at one time, that several of the bedroom bells at Lantarnam House were set ringing.—*Monmouthshire Beacon.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 2, W. Ball, Esq., on the Comic Literature of the Kingdom (apart from the Drama). Friday, Oct. 4, T. Walker, Esq., B. A., on Astronomy. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 3, T. Claxton, Esq., on the Steam Engine. At half past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Oct. 1, Quarterly Meeting.

QUERIES.

1. In the making of water colours, how are they formed into square cakes, and stamped? 2. How to make Frankfort black? 3. How to make infusion of gentian as it is sold in the chemists' shops? F. F. F.

Where can I obtain at the cheapest rate a small boiler for a model of a steam engine (say four or five inches in diameter); also small tubing and stop-cocks for the same? Could not I construct one with a ball-cock, such as those commonly used for cisterns?

A CONSTANT READER.

How to make a cement to join wood to glass?

A SUBSCRIBER.

[Shell lac dissolved in spirits of wine, with the addition of a small quantity of isinglass dissolved in diluted spirit; or if the nature of the materials will allow it, shell-lac alone, which is more convenient, and dry as soon as it is cold. The two surfaces must be heated to the temperature of melted shell-lac, otherwise it will not adhere.—ED.]

ANSWERS TO QUERIES.

To Remove Warts.—"Alpha." I have seen warts removed by applying the juice of apples to them. I have a brother, about ten years old, who had his fingers almost covered with them. He was advised about two months ago to cut an apple through the middle, and apply the juice to them, when in the course of a fortnight they were completely removed, and his fingers are now as smooth as silk. A. W. G.

French Polish.—Take three quarters of an ounce of seed lac, three drams gum juniper, two drams gum mastic, and four ounces spirit of wine, avoirdupoise; powder the ingredients, and mix them with the spirit in a glass bottle that will contain double the quantity. Set the mixture in a warm place, and shake it twice or thrice a day, taking care to loosen the cork during the shaking. Four or five days will be sufficient for dissolving the resin, when it will be fit for use.

The Gases contained in the Atmosphere are 20 parts of oxygen, and 80 of nitrogen, upon which one of carbonic acid and a little hydrogen often encroach; but pure atmospheric air is composed of four volumes of nitrogen and one of oxygen, exactly; that is, five pints of air contain one pint of oxygen, and four pints of nitrogen. Of the latter there are five compounds—First, 1 oxygen, 4 nitrogen; second, 1 oxygen, 2 nitrogen; third, 1 oxygen, 1 nitrogen; fourth, 3 oxygen, 2 nitrogen; fifth, 5 oxygen, 2 nitrogen. The first union forms air; the second, nitrous oxide, or laughing gas; the third, nitric oxide; the fourth, nitrous acid; the fifth, nitric acid. The first two are respirable; the others are destructive of human life, though phosphorous burns rapidly in the third. Nitrogen combines only with one solid, viz. carbon, in the proportion of 2 carbon, 1 nitrogen, which forms cyanogen; 1 of this, and 1 of hydrogen, form the deadly hydrocyanic, or prussic acid. Oxygen is the great supporter of life and combustion, and combines with all the simple solids.

Barometer Tube.—This may be cleaned with a mixture of hot water, sand, and subcarbonate of potash (salt of tartar).

"Alpha" will find two pennyworth of nitrate of silver answer his purpose well—*probatum est.*

"Publico" may make his cases firm as wood, by pasting his paper all the way down, and rolling it round, about forty times.

To procure Hydrogen.—Hydrogen is most readily made by melting a piece of zinc in a tobacco pipe, and pouring it from a height into water to reduce it to small pieces. Collect these, and put them into a wine bottle, with a quantity of sulphuric acid, and six times as much water.

"T. S. R." may obtain sheet zinc at any plumber's for about fivepence a pound.

To Dissolve India Rubber.—"F. P. H. T." will never, we fear, be able to dissolve India-rubber in spirit of naptha alone. As for coal naptha, we believe chemists sell little else. We can recommend a mixture of spirit of naptha and spirit of turpentine, as we have tried it, and succeeded.

W. W.

TO CORRESPONDENTS.

W. G. C. will perceive that the present number commences the Fifth Volume of the MECHANIC *and the second of the New Series; the great number of Supplements, or double numbers, which we have lately published, is the cause of our deviating from the intention we formerly expressed of terminating the volume at the end of the year.*

We have received several books, the notice of which is unavoidably deferred till next week.

Owing to the late hour at which we received the interesting account of Col. Pasley's last and successful experiment on the wreck of the Royal George, we are compelled to defer, till next week, the answers to numerous correspondents, which should have appeared in the present number.

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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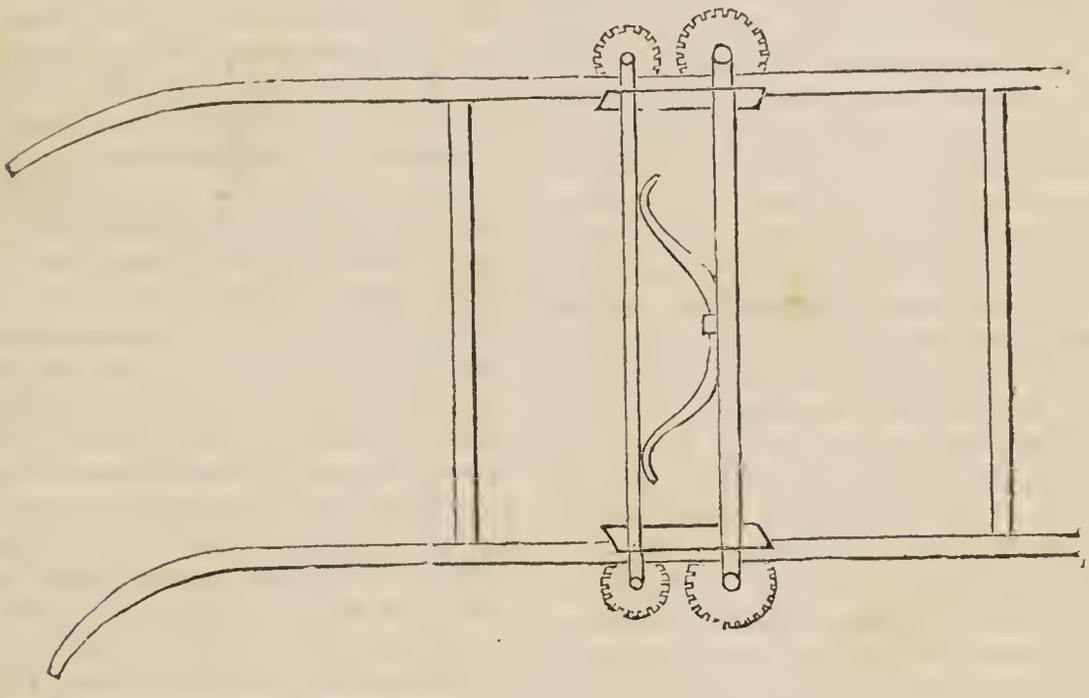
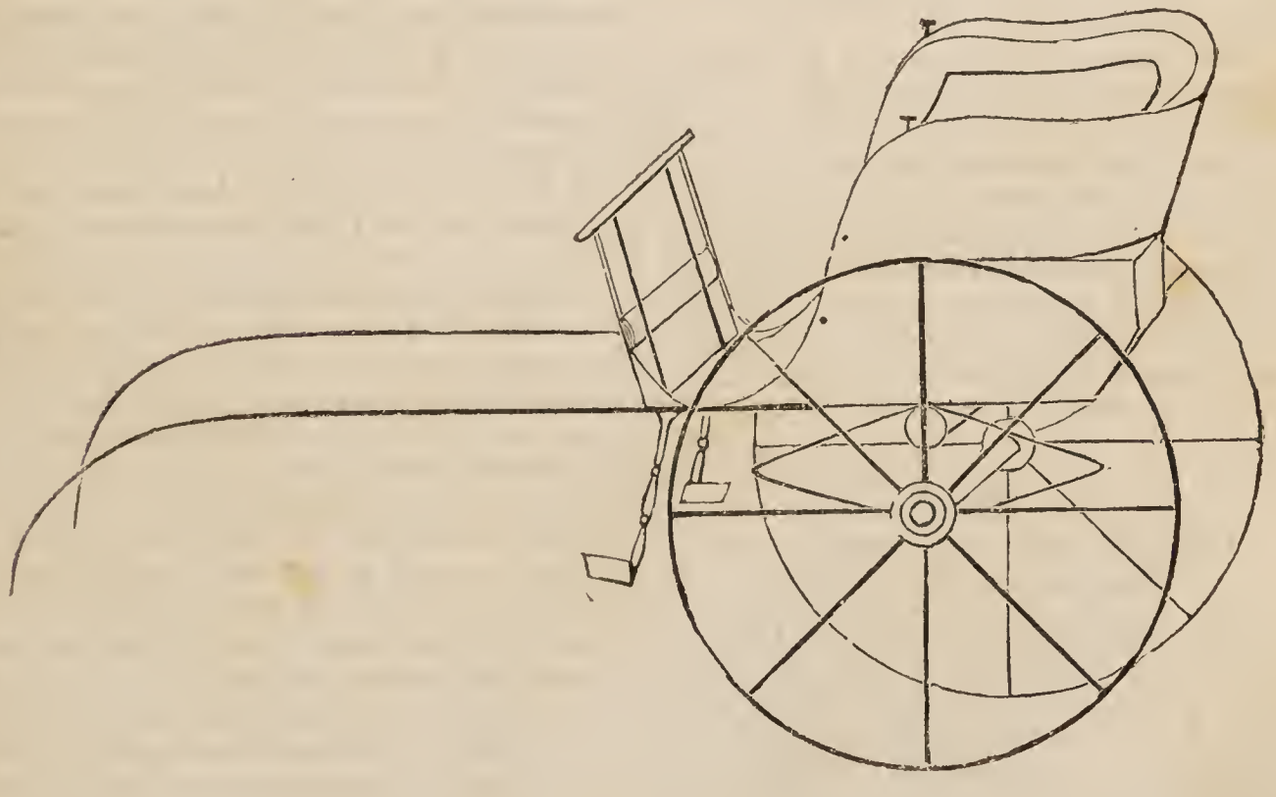
APPARATUS TO PREVENT HORSES RUNNING AWAY.





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APPARATUS FOR PREVENTING HORSES FROM RUNNING AWAY.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—In page 130 of the second volume of your magazine, there is a description of a proposed plan to prevent horses running away. There is also another plan in page 209, both of which may in some measure answer the purpose; but yet they are very defective. I have lately invented a plan far superior to either of the above. With my apparatus, I can in one moment not only stop the horses from proceeding, but can prevent their backing or turning to the right, or to the left, and the next moment release them, and again allow them to proceed; and if they still prove restive, secure them as before. This can be done without the driver moving from his seat, or putting either whip or reins from his hands. It is so easily managed, that a lady, or even a child, has a perfect command over it. It can be attached to any kind of vehicle now in use with little expense, nor is it at all unsightly. It is always ready for use, as there is no spring to wind up, or latch to set, as in the first of the two above mentioned; nor can it strain the carriage or gig in any way, as the second is likely to do. It will be found particularly convenient to commercial travellers and others who have at times to leave their gigs at the doors of those persons upon whom they call, as a horse cannot possibly move from the place where left by the driver, when confined by this apparatus.

The reason why I have not sent a more exact description of my invention is, that my circumstances will not allow me (after all the time, trouble, &c., which it has cost me) to make my invention publicly known without remuneration; but if any person with capital is inclined to assist me in procuring a patent, or otherwise securing the benefits arising from the invention, I am disposed to treat with him.

I remain yours, &c.

A. B.

DEPARTURE OF THE NEW ZEALAND COLONY.

THE Directors of this Company, together with a vast number of persons interested in the colonization of New Zealand, made an excursion to Gravesend on Saturday se'nnight, for the purpose of inspecting the ships which, under the auspices of the Company, have been freighted with emigrants to that distant region, and for the purpose also of transacting other important and interesting business connected with the foundation of the new colony. The *Mercury* steam-boat was employed for the occasion; and though one of the largest vessels engaged between London and Gravesend, her decks and cabins were completely thronged by the multitude of persons who had been invited, every one of whom had a deep interest in the object of the expedition. The *Mercury* herself was gaily dressed in the colours of all nations, the red cross of England floating supreme above the rest. An ample awning covered the after-deck; an excellent band of music was stationed in the waist. She left her moorings at Fresh Wharf about one o'clock, and, contending the whole way against adverse tide and wind, reached Gravesend at half-past three. The three ships it was intended to visit—the *Adelaide*, the *Aurora*, and the *Oriental*—were moored immediately below the town. As the steamer approached, conspicuous by her colours, the emigrants on board these ships crowded upon deck, and received the Directors with loud and hearty cheers. The object of the Directors upon this occasion was twofold,—first, to see that their instructions for the comfort of the emigrants upon the voyage had been rigidly carried into effect; and, secondly, as the sanction of the Government has been withheld from the undertaking—as the infant colony has been left without the aid or protection of the Colonial Office—as no steps have been taken to secure the administration of English laws upon a soil which Englishmen are to inhabit—as all the hopes which, up to the eleventh hour the Company had entertained of even a slight recognition from the Colonial Secretary had been disappointed—under these circumstances, the second object of the Directors was to obtain, if not from each of the emigrants, at least from the great body of them, a voluntary agreement to a charter or code of laws laying down regulations for the maintenance of order, and establishing a machinery for the administration of law and the enforcement of justice. The first ship that the steamer ran alongside was the *Adelaide*. She is a fine vessel, and has been admirably fitted up for the purpose for which she is employed. The arrangements for the comfort and convenience of the passengers of the lower as well as the higher class, appear to be complete. The berths betwixt decks are commodious, and well ventilated; the stores are of the best description—the dietary is ample: in

short, no pains nor expense appear to have been spared to secure the health and comfort of the emigrants upon their long voyage. As soon as the Directors, accompanied by the cabin passengers, and a host of visiters, had reached the poop, the labouring emigrants, with their wives and children, were summoned into the waist; when they were addressed by Mr. G. F. Young, the principal Director present, to the following effect:—"My friends, as one of the Directors of the New Zealand Land Company, I am anxious to address a few words to you upon a subject of great importance to you all. You will, I hope, be aware, from all you have seen as to the arrangements made for your passage to New Zealand, that the Directors of the Company have not lost sight of that which it is equally their duty and their pleasure to perform—have not failed to do every thing in their power to promote your comfort and welfare. But their views for your good are not bounded by providing for your departure from this country—they cast their eyes beyond the present, and contemplate what your position may be in that far distant land, where as yet no such provisions have been made as in every well-organised society are absolutely indispensable for the maintenance of order and the protection of property. The time cannot be far distant when the Government will do that which it is bound to do; but in the mean time it is necessary that some measures should be taken by which you may be protected from those aggressions upon social order which might arise if you were left wholly without laws and the means of obtaining justice. I am therefore about to propose to you to enter into a voluntary agreement, by which the ends I have indicated may be secured to you. I propose to you to sign the document which I now hold in my hand, and which, under the peculiar circumstances in which you are placed, I am sure you will find absolutely indispensable to your security and happiness." The honourable gentleman then read the document at length. It was in substance as follows:—that all the persons and parties to the agreement should submit to be mustered and drilled in such fashion, and at such times as should be deemed necessary to the security of all; that if any person committed an offence against the laws of England, he should be liable to be punished in the same manner as if the offence had been committed in England; that a Committee, to conduct the government of the colony be appointed, with power to make rules and to appoint officers; that an umpire be appointed to preside in all criminal proceedings, and, assisted by seven assessors, to decide on the guilt or innocence of the party accused; that where the assessors (whose office would be similar to that of jurymen in this country) pronounced a party guilty, the umpire (whose office would be similar to that of a magistrate or judge) should state the amount of punishment to be inflicted; that in all civil proceedings the umpire should proceed alone; that the General Committee should have power to appoint five of its members to constitute a Committee of Appeal, whose decisions, in all cases, should be regarded as final; that the Committee should have power to call out the armed inhabitants whenever the occasion required; and, finally, that it should have power to levy such rates and duties as may be necessary for the government of the colony. "Thus, no person can be left in any case, civil or criminal, without the means of prompt redress. It is to be observed, however, that these rules are only intended to remain in force up to the time when British law shall be established under the authority of the British Government, in that magnificent colony which you are to have the pride and happiness of being the first to found."

This address, which was very attentively listened to, was received with a hearty cheer. Every man seemed to concur in the propriety of the proposed code of laws; and when it was placed upon the capstan for signature, there was not one who hesitated to put his name to it.

This part of the business being concluded, the steamer next ran down to the *Oriental*, who received her with a salute fired from half a dozen large guns upon deck. We observed that each of the ships was armed in a similar manner; there was also in each of them an abundance of small arms. The emigrants on board the *Oriental* are of a very superior class. They are chiefly young men and women of from twenty to thirty years of age—the women looking healthy and buxom, the men intelligent and resolute. Here, too, are a number of Highlanders from the estates of the Duke of Sutherland; they are a fine, hardy set of fellows, and capable, no doubt, of fighting their way in any region of the world in which they may be placed. Great care appears to have been taken to secure their comfort. They are clad in one uniform dress—a blue jacket and cap, and tartan trousers—everything upon their backs happens to be perfectly new. The noble duke's agent who has accompanied them from Scotland, remains with them

until the expedition takes its final departure. Mr. G. F. Young, in going through the same ceremony on board the *Oriental*, that had previously been gone through on board the *Adelaide*, addressed himself particularly to this body of men. "I perceive," said he, "that there are many here from Scotland. Scotchmen are generally well educated and well informed in the history of their country. Those whom I am addressing will doubtless remember the solemn league and covenant which, in a former age, was entered into by their countrymen. I now propose to you, the descendants of that firm and inflexible race of men, to enter into another solemn league and covenant for the maintenance of social order in the new society of which you are to be the founders." (Cheers.) The code of laws was received on board the *Oriental*, and afterwards on board the *Aurora*, with the same expressions of approbation as on board the *Adelaide*. It was signed by every man present. Each of the three ships having been visited in turn, the steamer ran back to Gravesend, and preparations were made for dinner. Tables were set out beneath the awning on the after-deck, and in a few minutes were covered with a choice and abundant cold collation. The host of visiters took their seats, and turned to at the solids with right good will; but the enjoyment of this long-anticipated part of the day's proceedings was sadly broken in by the torrents of rain which fell without intermission, against which the awning afforded but a very imperfect protection. The ladies hurried below, where in a short time they were followed by the gentlemen. Here a handsome dessert was quickly produced, and with a copious supply of many kinds of wine upon the table, every one began to make himself comfortable. Now, however, the vessel was again put in motion for the purpose of once more visiting each of the three ships, and of taking a final farewell of the emigrants. Some touching scenes occurred in the separation of friends who had lingered to the last moment; but, generally speaking, the whole body of adventurers, rich and poor, male and female, appeared to be in the highest spirits. It may be here proper to mention, that independent of the three ships of which we have been speaking, there are two others which form part of the same expedition, namely, the *Duke of Roxburgh*, which will take in her passengers at Plymouth, and the *Bengal Merchant*, which will sail from Glasgow. The number of emigrants on board each of the ships is as follows:—*Oriental*, 138; *Adelaide*, 149; *Aurora*, 142; *Duke of Roxburgh*, 120; *Bengal Merchant*, 155; making a total of 704, exclusive of cabin-passengers, whose number on board the five ships amounts to 152.

When the farewells of friends and relatives had been finally exchanged, the *Mercury* took a homeward course; and Mr. G. F. Young immediately assumed the chair in the state room, where upwards of a hundred guests still remained. Now the bottle began to circulate, and a second course of business commenced. There were toasts to be proposed and speeches to be made. The chairman, in the first place, acquainted the company that he had received a communication from Lord Petre, apologizing for his absence, but stating that, as he had a son embarked in the enterprise, his feelings would not permit him to take part in the proceedings upon the eve of his departure. Lord Durham, the Governor of the Company, was also unavoidably absent, having left town for the country. These preliminary matters disposed of, the chairman came to the list of toasts. The first was "The Queen," which was loudly responded to. Then came "The Army and Navy," which was received with applause. The great toast of the day followed—"The Colonists now embarked and embarking for New Zealand." In proposing this toast, the chairman entered into a lengthened but forcible exposition of the difficulties against which the Company had had to contend, in consequence of the refusal of the Government to lend any aid or protection, or even to afford the slightest countenance to the undertaking. He explained also the steps which the Company had taken to preserve the rights and improve the condition of the aborigines; observing that in this respect the present scheme of colonization differed from all others that had ever been carried into effect.

Dr. Evans, the chief colonist, returned thanks in a very able speech; in the course of which he commented in still stronger terms than the Chairman had done, upon the conduct of Government in refusing to lend its sanction to an undertaking of so much importance. Then, speaking of the aborigines, he said, "There are no men on the face of the earth who have a more sincere or heartfelt desire to preserve the rights of the aborigines than we have who are about to depart to those distant shores. We feel that they are our adopted countrymen—*(Cheers)*—and that a wrong or an injury inflicted upon them would be an injury upon ourselves: we will be parties to no transaction in which their rights are

not consulted equally with our own." *(Cheers.)* He concluded by proposing "The health of the Governor and Deputy Governor and Directors of the New Zealand Company.

The Chairman returned thanks.

The Honourable Frederick Tollemache proposed "The health of the members of the Committee that day appointed for the Provisional Administration of the affairs of the Colony."

Mr. Dudley Sinclair returned thanks.

The Chairman then, in a speech of much tact and ability, proposed "The health of Lord John Russell, and Reform in the Colonial Office." He had always regarded, and still continued to regard, the Colonial Office as the worst-managed (owing to the defects of the system itself) of any of the departments of the public service; but he owned he anticipated much from Lord John Russell's frank and manly character—from his readiness to correct abuses, and from his sense of justice.

The toast was drunk with applause.

Several toasts followed. In fact, the list had not been exhausted when the vessel reached her destination at London Bridge.

There were present during the excursion the Honourable Frederick Tollemache, Right Honourable Sir Alexander Johnson, Honourable William Petre, Honourable Henry Petre, Mr. Aglionby, M.P., Mr. Vincent Eyre, Mr. Commissioner Evans, the Rev. Mr. Hawtrey, of Eton, the Rev. Mr. Saxton, Mr. Browne, late M.P. for Sligo, Mr. Few, Mr. Somes, the Deputy-Governor of the Company, Mr. G. F. Young, Mr. Edward Gibbon Wakefield, Mr. Alderman Pirie, Mr. T. A. Hankey, Captain Nairne, Mr. Arthur, Willis, and Mr. Boulcott.

[The foregoing has appeared in several of the London papers, and may be considered as a fair report of the proceedings. The climate of New Zealand is temperate and pleasant; the soil is fertile, and its productions numerous and valuable; its geographical position, with respect to the vast territory of Australia, promises, at some future period, great commercial advantage and importance; it is the interest, as well as the duty, of every true Briton, to promote the extension and security of "the great empire on which the sun never sets." Every friend to his countrymen, and every friend to humanity, will join us in cordially and ardently wishing success to this bold and perilous enterprise; *but* we cannot witness the departure of the expedition, and refrain from expressing that the deep interest we feel in the welfare of the colonists, is accompanied with much anxiety for their safety. They are going to the world's end; for New Zealand is situated at the antipodes, that is to say, it is the remotest country in the world; they are to be abandoned to their own resources, in a wilderness swarming with herds of howling savages, whom Dr. Evans very politely designates "our adopted countrymen." At the very moment of departure, Mr. Young, one of the Directors of the Company, announces, in a sort of parenthesis, that the government of this country has refused to grant them any sanction or protection, either civil or military; but, he adds, the views of the Company for their good, are not bounded by providing for their departure from this country, but, in the absence of positive assistance, they very generously proffer their *advice*, which is, that they should agree among themselves to be their own lawyers, their own judges, their own soldiers, and their own tax-gatherers. It is no doubt very good fun for gentlemen in the state room of the *Mercury*, during their passage to London Bridge, to find "an excuse for the glass," by huzzaing to the health of Ministers who, in their solicitude for places which "touch them more near" than the distant and precarious colony of New Zealand, abandon the adventurous emigrants to their fate. But we cannot divest ourselves of the apprehension that the adventure is one of great hazard and danger.

Ed. M. & C.]

THE EGLINTOUN TOURNAMENT.

The "tournament has proved such a comical, as well as unlucky piece of business—has been so roared at, and so rained on—so pitifully handled by gods and men—that we can hardly find it in our hearts to subjoin anything provoking about it. The account given of the cavalcade going to the lists on Wednesday, the first day of the proceedings, will long remain one of the most heart-rending narratives in the English language. They went *by water*.

"Shower succeeded shower," says a respectable and soaked witness, "each heavier and of longer continuance than its predecessor; and the boundless expanse of heads at length permanently disappeared under a co-extensive canopy of umbrellas."

"At three o'clock," we learn from the same dripping authority, "a perfect deluge of rain was descending;" and the procession about this time "was seen advancing *to the astonishment of everybody*."

It is highly interesting, by the way, to remark the difference between the English and the Scotch reporters in the tone of

their remarks on this affair of the wet. While the former, born to drier circumstances, fret and chafe themselves into all manner of horrid frames of mind, taking every minute savager views of things in consequence, the latter—wet from childhood—are able to maintain their habitual equanimity, suffering no adhering nankeens to distort the judgment, no saturated under-linens to betray them into hasty remarks. Thus the reporter for the London *Chronicle*, who has no doubt caught his death of cold, instead of taking James's powders, puts himself into almost as good a perspiration by the vehemence with which he falls out with the whole of the expedition; and the *Post's* correspondent, who seems rather of the sarcastic order of writers, takes the same revenge in another shape, when he drowningly remarks—"It does not always rain in Ayrshire, they say, for sometimes it snows. Murphy could hardly fail to make out an accurate programme of the weather for this part of the country, and would only be puzzled in fixing the seven fine days which it is reckoned occur in the course of the year."

Many hard words and cutting reflections have been applied to the knights and their performances; more, we think, than were fairly proportioned to their deserts, considering the severity of the punishment already sustained. The business generally, according to one witness, was "a magnificent abortion:" another gathers the "popular opinion," which he states to have been, "that a greater piece of humbug was never yet practised in the open air." Much exception has been taken to the "lances;" which are a sort of mopsticks, such as servant-girls twirl of a morning before the house-doors, but differing from that weapon in respect of being made weaker and in such a manner as to snap in the middle, and being moreover "rounded off at the end." They were, says one account, "cut across the grain;" and another describes them as "cunningly enfeebled." All accounts appear to agree in making them out a sort of *emasculated mopsticks*.

To see some dozen people break emasculated mopsticks, there came wonderers from America, doubters from Germany, speculators from France—not uninvited. In what humour the nations have got home again, we can scarce trust ourselves to inquire. If they stir up no wars against us for this, we may be thankful. Only conceive! people coming three thousand miles across the seas to see they know not what—but something, they are assured, the most epical, most heroical, most fearful, yet beautiful ever seen, or ever to be seen in this life! There may be occasions in which money ceases to be an object—in which even the most regular man of business, even a Yankee merchant, may be justified in discarding the usual rules of prudence and economy, to seize on delights that can never again recur. This was such an occasion—an occasion "to draw three souls out of one weaver," and even more than three (say three hundred) rix-dollars out of the pocket of one cotton-broker. They come! From all parts, "the cry is still they come!" Wednesday, too, comes; Wednesday—day of days, ever to be memorable in their after lives as that on which all their previous notions of the sublime and beautiful, of the terrors of mortal combat and the limits of human bravery, were exceeded, and a new and nobler standard established in their stead—a day due to poetry, admiration, and enjoyment. Heigho, for the sequel! "Eloquar, an taceam?" With Wednesday, comes Wednesday's sky, that declares against chivalry. "The windows of heaven are opened." Down come the indiscriminate divine slops—up goes the "King of the Tournament's" brown silk umbrella—into a coach scuffles "the Queen of Love and Beauty." Chop-fallen is chivalry. Plumes refuse to "dance," banners won't "wave," flags are flagging; there is no glittering of helmets, no "glancing in the sun," no persuading barbs to "swallow the earth" to-day; no dying gladiators "biting the dust"—no dust to bite! Alas, alas! Harpers are mute, jesters are sad, "fools" look wise, and knights look foolish. Mr. M'Ian "of the London stage" sports in vain his cap and bells; he has no humour, in him, but much humidity. The middle ages *won't* return—that is decreed. What *should* they return for? To see themselves burlesqued? To see this sort of historical "high life below stairs?" To see the desecration of their old iron? To see the collision of emasculated mopsticks?—*Spectator*.

THE CHEMIST.

HENZE'S IMPROVED METHOD OF MANUFACTURING DEXTRINE.

THIS invention, for which a patent has been granted, consists in the production of dextrine, by means of the admixture of nitric acid with the farina of potatoes, or the flour or starch of wheat, barley, or other appropriate farinaceous grain or

seeds. By this process, the substance is obtained at much less expense than by the method hitherto employed.

The farina, or starch, being in a dry state, a portion of nitric acid, of the specific gravity of about 1.4, equal in weight to one-four-hundredth of the farina, is mixed with such a quantity of water as is sufficient to wet the farina, which is then carefully mixed with the fluid, so that every part may be wetted, as bread is mixed or kneaded. It is not, however, necessary (though Mr. Henzé considers it preferable) that the flour or farina of potatoes and similar substances, should be brought into a dry state, but it may be used as it is obtained from the tub or vat. In such a case, a less portion of water will be required in the admixture of the nitric acid.

The paste thus formed, is divided into lumps of any convenient size, say about twenty-five pounds weight, and these should be put to drain for a few hours, to allow any superfluous moisture to run off. The lumps should then be broken with the hands into small pieces, and placed in a chamber heated to any degree not exceeding 176° Fahrenheit, and kept there till perfectly dry, which at the heat of 176°, will be done within twenty hours, and they are then reduced to the state of flour, by pounding and grinding, and the use of a bolter or seive; and this flour is then placed in an oven, heated to from 212 to 248°, where it is kept till thoroughly dry. The time necessary for this purpose will vary according to the degree of heat, from about a quarter of an hour to five minutes; the lower the degree of heat within the prescribed limits, the whiter will be the dextrine, which is advantageous.

When required for use, the dextrine thus obtained is to be mixed with water, either hot or cold. The proportion of water varies according to the consistence of the liquor required, which differs for different purposes. The product is a gummy liquor, similar to the solution of gum-senegal in water, and its principal uses are a substitute for that gum.

The most general object for which dextrine is used, is in the printing and dressing of silk, cotton, linen, and other fabrics; in painting or printing paper hangings, in all sorts of distemper painting, in stiffning the different fabrics which require it, such as gauze, and in all the preparations which formerly required the use of starch and calcined starch, calcined farina, or British gum; also in the preparation of adhesive plaisters and bandages for surgical purposes, in glazing visiting cards and other papers; in short, it is a perfect substitute for gum senegal and other gummy and gum-like substances, in all processes of this nature, while it is much cheaper than any of them.

This is the substance recommended by M. Dumas as a varnish to protect the Daguerre pictures from injury.

MISCELLANEA.

Splendid Museum at St. Petersburgh.—The Emperor of Russia has approved of a design supplied by the Chevalier de Klenze, of Munich, for a new Museum for Sculpture and Pictures, and it is said the structure will probably be the most magnificent in Europe. It is to be attached to the Hermitage Palace, at St. Petersburgh. The entrance will be very striking, the giant figures of the Temple of Jupiter, at Agrigentum, in Sicily, having suggested its most prominent decoration. A superb staircase, with noble colonnades of marble or granite on each side, will lead to the upper range of galleries for the paintings, and no expence will be spared in order to make the museum exceed in splendour those of Berlin, Munich, or Paris.

Discovery of a Tesselated Pavement.—In a field adjoining the road leading from Rudston to Kilham, a tesselated pavement, about six inches from the surface, was uncovered—the tesseræ differing in size from one inch and a half to half an inch; colours white, red, and blue—white prevailing; laid in lines and forming diamonds, extending over a surface of about four yards by three yards, walled round on three sides with large rough stones, similar to the chalk stones of the Wolds. A great part of the pavement had been destroyed at a former period by some labourers who had dug it up in the hope of finding treasure, and the place filled up again promiscuously; it contained red bricks of a square form, $9\frac{1}{2}$ inches by $8\frac{1}{2}$ inches, $1\frac{1}{2}$ inch thick; pieces of plaster smooth on one side, and painted, some red all over, some in lines, and some with dashes of red and green, apparently water colours. Below this, at about $3\frac{1}{2}$ feet from the surface, were a number of tiles, in regular order, slightly curved, and having a flank at each side. They were placed flank to flank one with another, having the hollow side downward. The top surface presented an indented half circle, extending from one end to about one-third of the whole length. The size of each tile is about one-third of the whole length. These tiles measure about 15 inches by $11\frac{1}{2}$, and about three quarters of an inch in thickness. Immediately under these was another layer of the same sort of tiles, laid in the same manner, but transversely with each other. Below these was a small quantity of exceedingly black ashes, and near were some pieces of a rather honey-like substance, porous, and having a great semblance to the incrusted mass from the Dropping Well at Knaresborough. Still lower was a layer of fine rich earth, a few inches in thickness, and then a bed of fine natural red clay, probably the material similar to that of which the bricks and tiles had been formed.—*Hull Advertiser.*

Advantages of Railway Travelling.—So much for the mode of travelling; but the facilities which it will afford to pent-up citizens to migrate from their confined atmosphere, and dismal scenery of brick and mortar, into the fresh free air and beautiful expanse of the country, are still more important benefits conferred by railroads. Southampton and the Isle of Wight will be as near at hand as Richmond was in the days of yore; the balmy breezes and calm bays of Devonshire will be distant but a few hours' trip. Who then would deny himself the pleasure of beholding with his own eyes the beauties of his country, or pine in disease for want of healthful recreation? To a benevolent mind, the pleasure derived from travelling by railroad must be much enhanced by the consideration that the rapid, agreeable motion is produced by the action, not of sentient bone and muscle, but by that of inorganic, insensible agents.—*Curtis on Health.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 9, W. Ball, Esq., on the Comic Literature of the Kingdom (apart from the Drama). Friday, Oct. 11, T. Walker, Esq., B. A., on Astronomy. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 10, W. Maugham, Esq., on Lime, Baryta, and Strontia, and their use in the Arts. At half past eight.

ANSWERS TO QUERIES.

To take out the Stains of Red Ink.—Perhaps chlorine, or some of its preparations, will answer "T. R.'s" purpose. He can obtain sheet zinc in small quantities at any of the zink works in the New-road.

"Publico." All that is required to form ultramarine, carmine, or other colours into cakes, is a strong mucilage of gum tragacanth.

Naptha.—"F. P. H. T." is informed, that naptha may be procured from Spencer's in Fleet-street, from Robinson in the Minories, or from Cassell's, Mill-wall, Poplar, at from 3s. 6d. to 7s. 6d. per gallon, which will dissolve India rubber. If about one pound be cut up into thin shreds and boiled in water for a few minutes, then taken out and put in the naptha), which is better by being kept close covered, and the jar placed near the fire, or in a pan of boiling water; if stirred about once every hour, it will be fit to use in three hours' time. Should it be required very thick, less naptha may be used; but the above makes an excellent solution.

To destroy Warts, rub them every day with the inside of the broad Windsor bean shell.

"Henry" can refer to page 104; respecting nitrous oxide gas, to page 200.

I have generally found turpentine take out grease.

To make Hydrochloric Acid Gas.—Put a certain quantity of common salt into a retort that is made with a stopper on the top, then pour the same quantity of strong sulphuric acid on it, when a brisk effervescence will be produced, and white fumes will come over. This is the gas mixed with the atmosphere. To collect it, it is requisite to have a trough filled with quicksilver, and having a shelf fixed across the trough just beneath the surface of the quicksilver, with a hole fixed in it for a bait pipe to lead from the retort into the trough; the gas will be purified by passing through the quicksilver, and escape through the hole in the shelf, where it may be collected into a receiver placed over it. A Florence flask and tube would do equally as well as a retort.

I have read the article on "Penny Postage," and consider the plan of a stamping room an additional expense, no saving of time, and no doubt would create great and innumerable frauds, by allowing persons to take away letters after stamping and previous to their reaching the party addressed, thereby bearing the mark which is to be the proof in any dispute or litigation.

W. P. C.

TO CORRESPONDENTS.

W. P. C. *has our best thanks; the Index and Preface to Vol. IV., with Railway Map, &c., will be published on the 26th of October.*

T. L. M.—*We should advise him to address his memoir to the Post-master General, stating that it is a proposal of a plan for carrying into effect the Penny Postage Act. If he wishes any part, or the whole of his communication to remain secret, he may nevertheless have our opinion, and, if such be his wish, it shall not be published or otherwise divulged.*

W. S. C.—*If he will forward the papers on elementary chemistry, they shall be carefully examined, and, if possible, inserted.*

Our next being a double number, we shall be enabled to liquidate a considerable portion of the debt we have contracted with our correspondents.

A SPLENDID RAILWAY MAP!

With the MECHANIC AND CHEMIST of October 26th, will be presented (gratis) a

SPLENDID MAP OF ENGLAND AND WALES, showing, in addition to all the Principal Towns, the routes of the Railways through the various Counties; forming a handsome Frontispiece to Vol. IV. To ensure early impressions, give immediate orders to your Booksellers or Newsmen.

London: G. Berger, Holywell-street, Strand; and all Booksellers in Town and Country.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 53 & 54, NEW SERIES. } SATURDAY, OCT. 12, 1839. PRICE TWO-PENCE. { Nos. 174 & 175, OLD SERIES.

COLES' LOCOMOTIVE ENGINE.—Fig. 1.

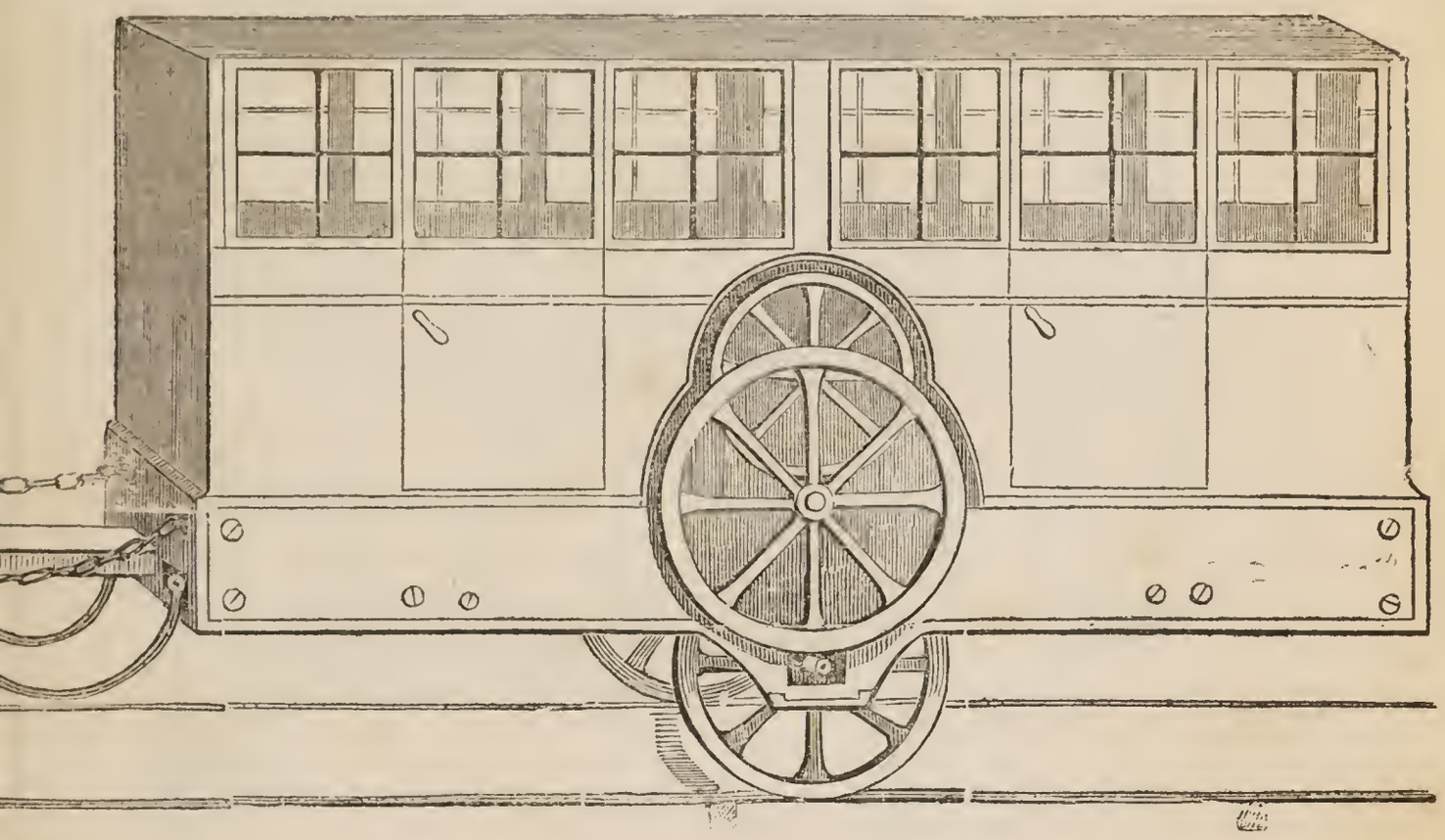
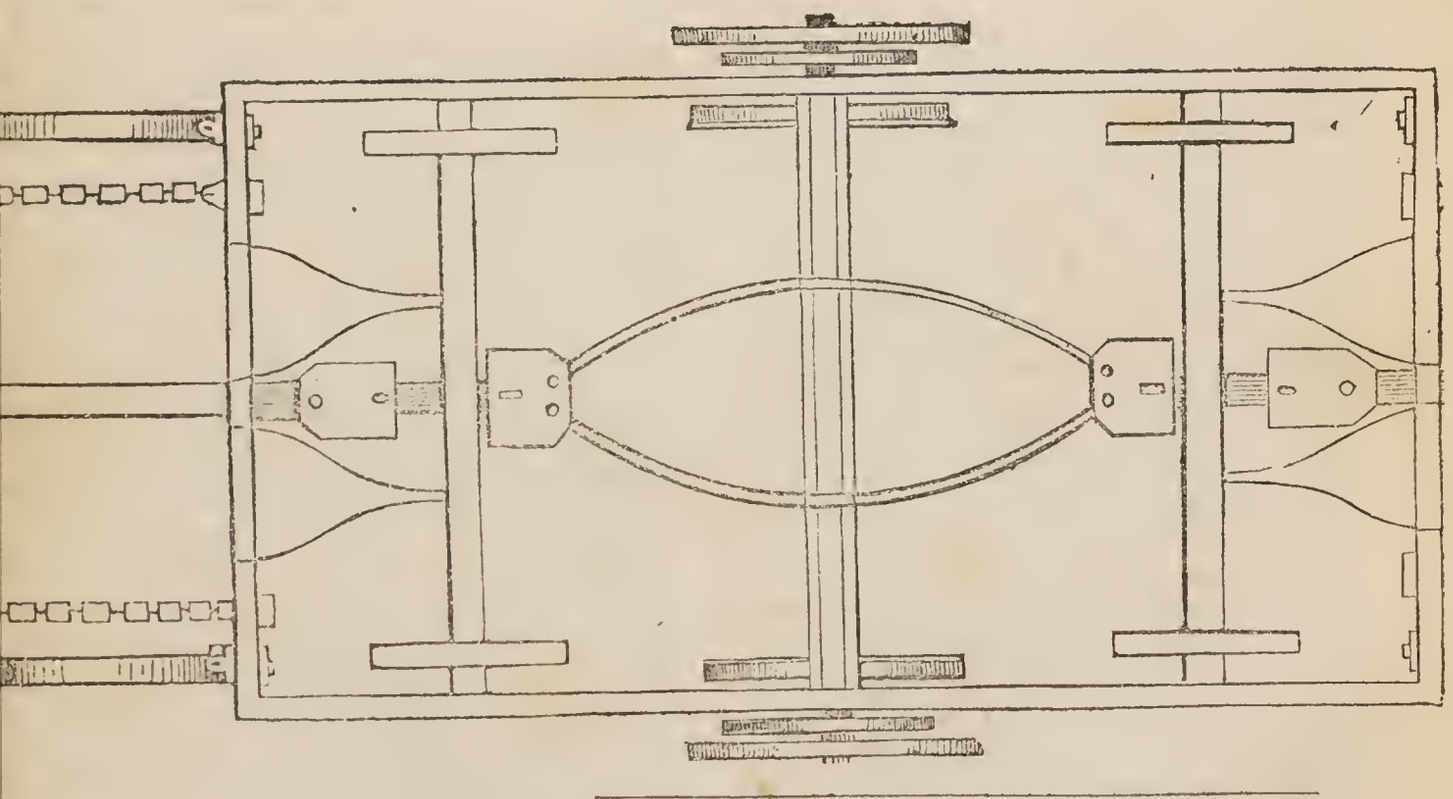


Fig. 2.



VOL. V.—Nos. 4 & 5.]

City Press, 1, Long Lane, Aldersgate Street ; D. A. Doudney.

COLES' LOCOMOTIVE ENGINE.

(See engravings front page.)

THE drawings (figs. 1 & 2) are from models of a two-wheel carriage, made upon a scale of one inch to the foot, for which patents have been obtained for the United Kingdom, France, and America. This engine is propelled by machinery (fig. 3), which works a pinion having a large

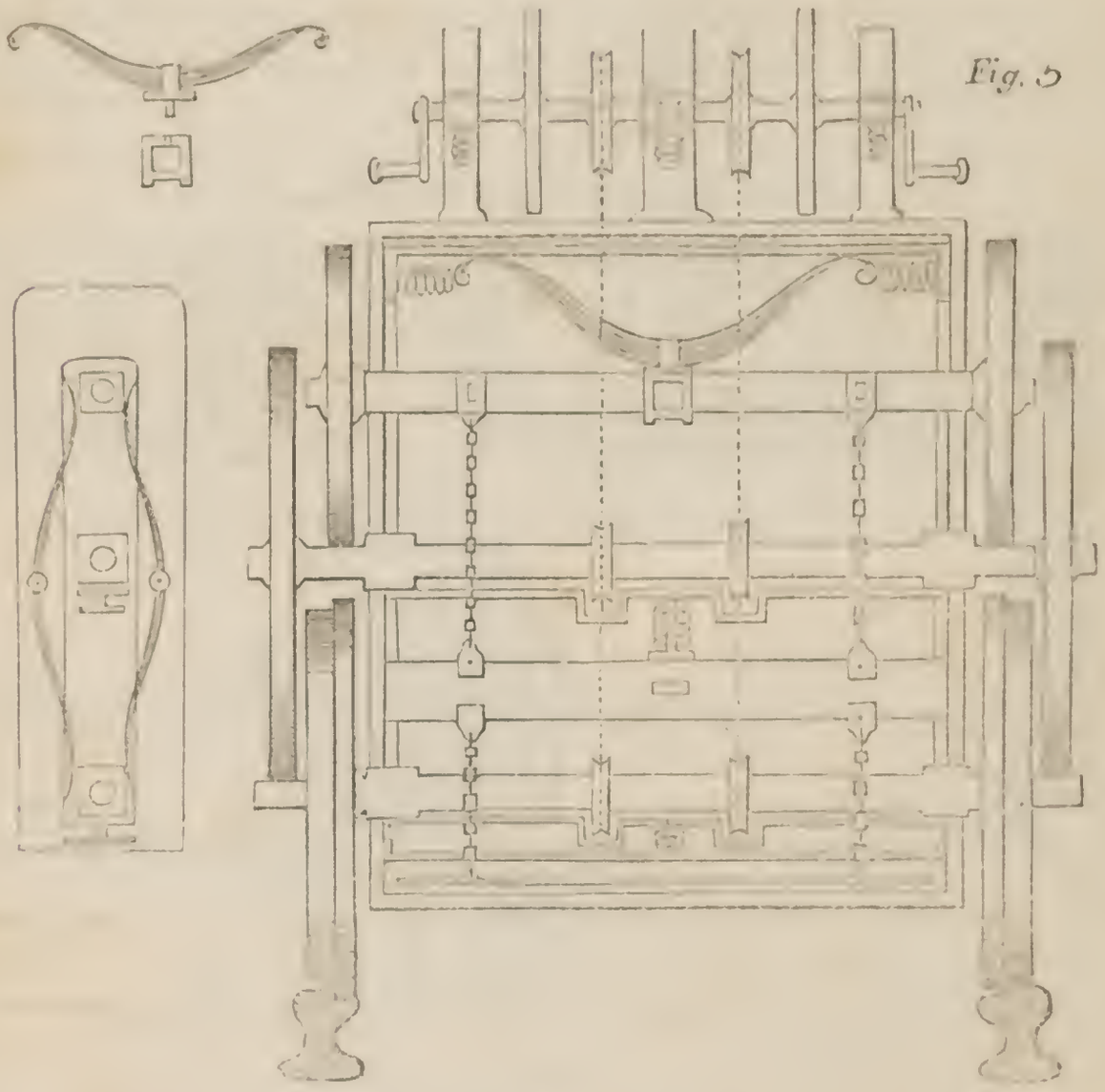


Fig. 3

sheeve, with stubs at equal distances, the axle of the ground wheels having also a sheeve of half its size, and an iron chain working over them, with which there is no friction as with cranks; and when they are set in motion, the axle of the ground wheels, instead of bearing in the collar, works upwards against the rim of the large anti-friction wheels, and in like manner the axle of the latter is met by the rim of the upper wheels, which are in reality the friction wheels, as they revolve upon a fixed stub axle screwed to the frame-work of the carriage, which sustains the whole weight of the frame, body, and passengers. This carriage will traverse round a circle thirty-four feet six inches in four seconds, or at the rate of seventy-one miles in an hour, or propel one two-wheel carriage at the rate of fifty. They are constructed in a variety of forms, and are peculiarly adapted for working in mines, the bodies being made to carry their burden close to the rails or trams, if required, and tunnelling may in many cases be avoided.

"I shall proceed," says Mr. Coles, "to show how the friction between the flanges of the off wheels and the rail when working curved lines may be dispensed with; and, what is of still greater importance, viz., every two-wheel carriage in the train is a locomotive, capable of propelling a train by manual labour. Two men would propel four two-wheel carriages laden with passengers, the mails, &c., whilst the heavy goods may be conveyed in the four-wheel carriages. Manual labour is better adapted to work them than horses or steam power, as neither could resist their progress when descending; and trains of ten or twenty carriages may be propelled at the rate of forty or fifty miles in one hour with perfect safety, and without producing a heated axle, as the upper friction wheels relieve all the lower wheels

of their friction, and revolve but once, while the ground wheels revolve seventy-five times; of course there could not be one hundredth part of the wear in the working wheels. The friction is now so trifling in the axles, that every ton will draw four hundred tons when working on a level surface. It is generally admitted that there is greater friction between the flanges of the wheels and the rails in particular curves, than in the bearings of the axles; and when I have shown that carriages may be constructed that they shall not come in contact with the rail, the resistance would be so trifling, that manual labour will compete with steam, they could do more work, and with greater speed and safety, and with one quarter the per centage that is now paid for steam power. The labour required to work a hand locomotive, would be almost a sinecure when compared with sawing timber, threshing corn, and stable-boys' work, which the common labourer once had to perform (and of which he is now deprived by the introduction of steam), as six miles out of seven are either flats or descents, and where inclines do not exceed one in two hundred and fifty, they are as easily worked by hand as flats; their power to control, propel, or restrain their velocity, would be almost without limit.

To make four-wheel carriages work curves voluntarily, all the wheels must run outside the frame of the carriage; whilst the ground wheels of the two-wheeled carriage run inside the frame, the upper axle-tree must have a hole in its centre an inch and a half in diameter; a cross-stay must be fixed to frame, having a pivot in its centre; and the axle would move round it; another cross-stay must be fixed to frame under the axle of the ground wheels, having a pivot two inches thick, and a similar pivot would be fixed on the centre of the buffing bar; two strong bars of iron must be fixed underneath the collars or bearings of the axles of the middle and ground wheels from one end to the other; a hole would be made in the centre of each bar to receive the pivots on which they would move in right angles with the curves. The point of resistance is thus taken from the sides of the frame, and conveyed to the pivots in centre of axle trees; two arms would be bolted to each of those bars, and meet each other in the centre, forming a knuckle-joint; and when the fore wheels enter a curved line, the joint would act upon the hind wheels, and force the axles more distant on the outer curve, and closer together on the inner one, sufficient room being left in the groove where the collars work, to allow them to go an eighth part of an inch either way, or more if requisite. This may be termed a voluntary, self-acting principle; it is exceedingly simple, and admirably adapted for working curves on railroads. Two-wheel carriages do not require these improvements. I have also invented two other plans by which the wheels may be forced into a curve with mathematical correctness; and they are particularly adapted for common roads, to be propelled by manual labour, without the aid of horses or steam. The springs above the upper axle-trees are not to carry the burden, but to press the wheels down upon the rails, and to relieve them from any sudden jerk, when rebounding after passing over any uneven surface. If those springs were dispensed with, the upper axle must have been fixed to the frame, and when the machine passed over an unlevel surface, the wheels w uld drop, and the axles of the large wheels when rebounding would come in contact with the rims of the upper wheels, and abuse them. The springs have a rivet in their centre, the head of which would fill the hole in the axle and form a pivot, a hole being made in the centre of the upper axle to receive it: these pivots stand perpendicularly over each other, forming so many separate hinges, around which all three axles, with their wheels, would move; each axle bar would have two loops extending behind, and a bolt would pass through the loops, that they should all move together when working curves. Notwithstanding this improvement in the arrangement of the machinery, some slight alteration must be made in the present rails which form the outer curve, to enable the wheels to act correctly, viz., either an additional flat rail, laid down lower than the present rail, so that some portion of the outer wheel shall run alternately upon the rim of the wheel and upon the rail: the flange of the wheel may be about two inches thick and one inch deep. I would not allow more than a quarter of an inch play between the flange of the wheels and the rails. By the adoption of this plan, whatever the inner wheel gains gradually, the outer wheel, by running on its flange and taking a larger sweep, shall gain by degrees."

The velocity of steam carriages is so much greater than that of carriages crawling along the old roads, that many causes of resistance that are inconsiderable in the latter, become serious impediments in the former. The friction, and consequently the resistance on the axles of the working

wheels, though of secondary importance when compared with many other obstacles which are opposed to the attainment of high velocities, is, nevertheless, a subject worthy of consideration. The plan proposed by Mr. Coles, though less perfect than the old construction of anti-friction wheels (on account of the lateral friction he has introduced, by substituting the bearing upon a single wheel, for the angular bearing formed by the intersection of two circumferences) must, to a certain extent, produce an advantageous result; but he certainly overrates both the importance of his invention, and the inconvenience resulting from the construction at present adopted; and he even imagines difficulties which do not really exist. He says:—

"I thought nothing could be more inconsistent than to make such heavy carriages, and to carry such heavy burdens upon four bearings, when required to travel with so great a speed as they would be capable of doing, if made upon a much lighter scale, as the axle will swell with heat, and the collars would grasp their axle, and have no space for the oil to lubricate their bearings—in fact, they would become *immoveable* if their speed be continued."

Mr. Coles appears to forget that the collars are exposed to friction as well as the axles, and will also expand; so that the alterations in the relative diameters of the collar and axles, is only the excess of temperature of the one, above that of the other, which, considering that the utmost absolute expansion of the axle's diameter can scarcely amount to one five-hundredth part of an inch, and that of the collar, if not exactly the same, so nearly approximating to it, that the difference can only be appreciated by the most careful and accurate experiments; we are somewhat surprised at the assertion of Mr. Coles, that the wheels would "become immoveable if the speed were continued."

There is another assertion, still more unexpected than the foregoing, and which we cannot pass over unnoticed: we are informed that "where inclines do not exceed one in two hundred and fifty, they are as easily worked by hand, as flats"—the precise power required, and the most successful manner of applying it for working flats, we leave to Mr. Coles by experiment to determine; but that a rise of one in two hundred and fifty can be accomplished without the application of any more power than is required, *cæteris paribus*, on an horizontal line, is a doctrine which no engineer in this kingdom, except Mr. Coles, would venture to propound.

Mr. Coles is also remarkably unfortunate in his invention of a railway for curves of a short radius: the inconvenience and great danger which must result from the outer wheel "alternately resting upon the rim of the wheel and upon the rail" will always exclude that scheme from practical application. The following is the opinion and recommendation which we published in "the Mechanic" No. 37, July 27:—"A railway curve of half a mile radius, is bad and dangerous. Curve lines should never be laid on a plane surface; if the velocity of the train were invariable, and the outward rail raised to the proper height above the inner one, the engine would have no inclination to quit the line of rail, since the force of gravity would incline it inwards, as much as the rectilinear tendency of its momentum would incline it outwards. This effect may be exemplified by a very simple experiment:—In a bowl, or any concave spherical surface, project a round smooth ball, as a shot, or marble, taking care that the impulse be given in the direction of a tangent to an horizontal circle; the ball will revolve in a circle nearer to, or farther from the centre, according to the velocity of its projection. Now if a rail were formed in this circle, and a body moving upon wheels substituted for the ball, it is clear that that body, so long as its velocity is maintained by any force acting tangentially to the circular path, will move freely in the curve or circle, without tending in any degree to deviate from it. The great difficulty to be overcome in railway curves, proceeds from the inequality of the velocity of the trains; but assuming an average speed, and giving the rails a corresponding concavity, the inconvenience may be reduced to a small amount, unless the curve be of unreasonably short radius."

NEW ROTARY STEAM ENGINE.

At the recent meeting of the British Association, Mr. Gossage, of Stoke Prior, near Bromsgrove, read the following paper:—"A characteristic of the rotary engine, as originally constructed, is, that the whole of its parts revolve in the same direction, and that in whatever position of the revolution, its power is always the same, and the relative position of those parts which traverse or move in contact with each other is also the same. Any wear, therefore, which takes place, tends to increase the perfect fitting of the engine. The chamber in which the steam exerts its

alastic force, is the segment of a sphere, having conical ends, the points of the cones being towards the centre of the sphere; which arrangement forms an annular chamber. This channel is intersected by a segmental piston, or steam stop, which is fitted to the two cones, and also to the spherical part of the chamber, revolving steam-tight against the ball. A passage is formed through the lower cone, on one side of this piston, for the admission of steam, and a similar passage is formed on the other side for its escape; the communication between which is effected by a vertical shaft. If, therefore, no further means were provided, the steam would pass at once from the inlet passage, through the circular channel, and escape by the outlet passage, without yielding any mechanical force. The extent to which power can be obtained, is in proportion to the prevention of the escape of steam from the inlet to the outlet passage, except in consequence of the action of the engine, which action takes place after the steam has exerted its full force in impelling the piston. The prevention of this free passage of steam through the annular chamber, is effected by a circular disc or plate, which surrounds the ball, and extends to the periphery of the spherical chamber, to which it is made steam tight by metallic packing. This disc is so placed, that a radial line on its upper side is in contact with the upper cone of the chamber, and a radial line on its lower side is in equal contact with the lower one. The disc is mounted on a shaft, which, being supported at one end by a bearing placed at a suitable angle to the central vertical line of chamber, provides for the two sides being at the same time in contact with the upper and lower cones. As each revolution of the steam chamber and the disc must be effected in the same time, and as their axes are placed at an angle to each other, different radial lines of the disc and cones will be brought into contact with each other during these revolutions; and any given point of the disc will be continually travelling from the upper to the lower cone, during one half of the revolution; and from the lower to upper during the other half. The consequence of this traversing motion is, that smaller chambers are continually forming, from the intersection of the main chamber by the disc and piston. These chambers serve for the reception of actuating steam from the boiler, the steam being prevented from communicating with the outlet passage, in one direction by the piston, which divides the annular chamber, and in the other by the close contact of the disc with the upper and lower cones. One of these chambers increases in capacity in direct proportion to the revolution of the engine, until one half of each revolution is performed, when, by the change in the relative position of the disc and cones, the steam received is discharged; and, at the same moment that this change takes place, the formation of a new chamber for the reception of the steam commences. The chambers formed on the upper and lower sides of the disc are always in communication with each other, through the slit in the disc; and, therefore, the whole area of the piston on the one side, is in constant communication with the actuating steam, whilst this area on the other side, is also in communication with the outlet passage; and, consequently, the power obtained is uniformly alike. As the construction provides that the revolution of the disc and cones, in contact with each other, should effect the necessary alternate communication of the actuating chambers with the inlet and outlet passages, it will be apparent that the valves which are required for effecting these changes in the reciprocating engines are dispensed with; and the whole power obtained being communicated to the rotating shaft, to which the steam chamber is attached, it may be applied at once. Thus, the moving parts necessary, merely consist of a spherical chamber, with its two cones and a shaft, a piston, and a disc with its ball and shaft, the two nozzles and stuffing boxes for the passage of steam, the bearings for the two shafts, and the framework. The perfect action of these rotary engines depends upon the precision with which the fitting of the two sides of the disc against the upper and lower cones can be accomplished, and the continuance of this precision when the engine is working. As a matter of workmanship, it has been found that this precision is attainable with engines in which the steam chamber revolves on its own axis, and the two shafts revolve in fixed bearings. There are, however, circumstances connected with the action of the steam, which tend to effect a separation between the disc and cones, and thereby to admit of the passage of some steam without producing an equivalent mechanical force. During one half of the revolution, the area of the lower side of the disc, which is exposed to the full pressure of the steam, is greater than that of the upper side, which is similarly exposed. During this period, the pressure of the steam has a tendency to raise the disc from absolute con-

tact with the lower one; and during the other half of the revolution, a similar effect is produced on the upper side of the disc. The extent to which this effect can be produced must be extremely minute; as, to admit of its recurring at all, it is necessary that an actual compression of the metals, or a bending of the disc, must take place, as it is seen that the disc should be prevented leaving the lower cone by its contact with the upper one; and the reverse. Notwithstanding this, it is found that one half of each side of the disc, and one half of the surface of each cone, have constantly a polished surface, from their bearing against each other; whilst the other halves have no indication of being in absolute contact—thus proving that the effect before described does take place. One of the inventors of the new engine (Mr. Davies) was led, by the consideration of this action, to devise means by which leakage between the cones and disc might be prevented; and the further advantage secured, of rendering unnecessary that mathematical precision of adjustment, which was before required for obtaining the contact of the cones and disc. The principle consists in the adaptation of teeth, or cogs, to the disc and cones; these teeth being so arranged as to work into each other with great accuracy, in the same manner as the teeth of bevelled wheels. With this arrangement, instead of having a single radial line of contact between each side of the disc and the upper and lower cones, a number of teeth on the disc are in gear with an equal number of teeth on the cones; and as the suitable angle for the two axes is obtuse, this number may be extended to as many as seven teeth in gear at once. Thus, there are provided seven lines of contact in place of one; and as this contact of the teeth with each other is lateral, instead of being the contact of a flat plate against a round surface, any movement occasioned by the unequal pressure of the steam on the two sides of the disc, will only affect the depth to which the teeth are in gear, without disturbing the perfect fitting secured by their contact. For the sake of illustration, the disc and cones may be considered as bevelled wheels: it will be found that the diameter of the disc is considerably greater than that of the cone; yet these, if acting as wheels, must have an equal number of teeth, to secure their performing a revolution in the same time. According to the ordinary construction of the teeth of wheels, it would have been impracticable to effect this object; and it was, therefore, necessary to devise a mode of construction suitable for this purpose. On considering the manner in which the best constructed wheels work together, the inventor perceived that the form considered the best might be made available; the only modification requisite being the adoption of one portion, or the point of the ordinary tooth, for the larger wheel,—and the other portion, or its root, for the smaller. This modification being followed, the steam entering the chamber on the actuating side of the piston, will have a tendency to cause the disc to revolve on its own axis, in the direction contrary to that in which it should be impelled by the action of the engine; the amount of this tendency being dependent on the sectional area of the disc, multiplied by the pressure of the steam. The tendency of the disc to revolve on its own axis, is overcome by its teeth being in gear with the teeth of the cones; the power necessary being communicated through the teeth, which are retained in contact with each other, whilst the amount of resistance is not sufficient to occasion any material wear. The modification in the construction provides for an engine having only one moving part, viz., the disc; and this part moves in such a position, with regard to those with which it comes in contact, as scarcely to admit the possibility of any derangement occurring. Although this description applies to non-condensing engines, the same principle is equally applicable to those in which the steam is condensed. For this purpose, it is only necessary to provide a smaller machine of the same construction; which, being connected with the condenser, and actuated by the engine, performs the duties of the air-pump, with the advantage of its action being constant, instead of alternating, as in the reciprocating engine. The advantages derived from this application consist in the simplicity of the engine, which renders it much less liable to derangement than ordinary, and in the reduction in weight and bulk, as compared with the engines now in use.

MODES OF WATERING HORSES.

When the horse is at home, he is watered either in the stable from a pail, or in the yard from a trough, which, in racing establishments, is provided with a stout lock-fast cover as security against poisoning. In general, the horse seems to care little how he gets the water; but some will drink only from the trough, except when very thirsty. I know of no objection to

the trough, provided it be kept clean, and that the horse does not tremble after drinking from it. The water, however, is often very cold, and the man is often so very lazy, that he is unwilling to bring the horse to the door, and he makes two services stand for three. When the horse happens to be in the yard, he may get his water before going in; but at other times it is as well to make it a rule that the water be carried to the stable. Coming from a warm stable to the open air, and drinking cold water, the horse is apt to take a shivering fit. Each stable should be provided with water-pails always full, and standing in the stable.

In watering with a pail, the bucket is either placed on the ground, or raised manger-high to the horse's head. Old short-necked horses drink from the ground with difficulty, yet they always manage it. When the throat is sore, and when the horse is stiff after a day of severe exertion, his water should be held up to him. Some horses rarely drink well, and the less they drink the less they eat. They often require a little coaxing, and always a little patience. It is not enough to offer water and run away with it immediately. Hold the pail manger-high, and keep it before the horse for a little; after washing his mouth and muzzle he may take sufficient to create an appetite.

Post-horses are often watered on the road. They usually receive a little at the end of the stage, and also in the middle of it, if exceeding nine or ten miles. On the way home, the post-boy permits the horse to drink once or twice at watering troughs by the road-side. He does, or should endeavour to have, his horses fully watered, and cool by the time they arrive at stables. They are then ready for dressing and feeding without delay.

Horses are often taken to water at a pond or river some distance from the stables. If they need exercise or are passing the water, there is no objection to this practice. But it is not proper to send working horses out of the stable for the mere purpose of watering them. The weather, the state of the ground, and the laziness of stablemen, render this mode of watering extremely irregular. Boys, too, are often employed in this service, and they are never out of mischief.

With many grooms it is a common custom to give the horse some exercise after drinking. Some give him a gallop, while others are content with a trot or canter for a few hundred yards. Exercise after a copious draught of cold water is very useful. It does not warm the water in the horse's belly, as the groom says; but it prevents the evil effects which I have adverted to, in connexion with the temperature of water. Motion generates heat, and that which unites with the cold water can be better spared than if the horse were motionless. But the exercise need not be work. It is sufficient if it produce the least perceptible increase of warmth on the skin in eight or ten minutes. The man sometimes starts from the water at a gallop, but no good groom is guilty of this folly. Let the horse walk away for a few yards; from a walk he may proceed to a trot, and from that to a canter. In warm weather a walk is sufficient, and the pace need very seldom exceed a slow trot. The object is, not to heat the horse, but to keep him warm, to prevent shivering.

Water is not often given more than three times a-day. But in hot weather, when the horse sweats much, he often needs more water than it is safe to give at only three services. He should have it four or five times, and the oftener he gets it, the less he will take at once. Under ordinary circumstances, two rules will guide the groom. The first is, never to let the horse get very thirsty; the second, to give him water so often, and in such quantity, that he will not care to take any within an hour of going to fast-work. Water should always be given before, rather than after corn.

Broken-winded horses are usually much restricted in their water. I know that in stage-coaching they are not the worse for having as much as they please at night, provided it be given at twice or thrice, and not too cold.—*Stewart's Stable Economy.*

REVIEW.

A TALE ABOUT A GIANT AND A DWARF.

Extracted from a clever little Work, entitled "Chemistry no Mystery;" or, a Lecturer's Bequest." By John Scoffin. London: Harvey and Darton.

[We shall give some further account of this amusing and instructive volume next week.]

Of all the merry-makings which it has been my lot to see, none has ever pleased me so much as a village fair. The Lord Mayor of London's show, the King's visit to Parliament, and all other fine sights

put together, never afforded me half the gratification that I have felt from being present at a country fair. But my recollections of *all* country fairs are not pleasant, as will appear in the course of the tale which I shall presently relate; although I am convinced that the chastisement which I then suffered for an act of wanton mischief, taught me a useful lesson for my guidance in after life. It taught me in a practical manner something which I had heard theoretically advanced many times before: that knowledge is power, either for good or for evil, and is only conducive to happiness when enlisted on the side of virtue.

In the early part of June, some sixty years ago, I was present at the annual fair of my village. I was then about ten years old. The approach of the fair-day was a subject of pleasurable anticipation for every one within a dozen miles of the place: the village cottages were whitewashed; the rose-trees were pruned; the garden walks were nicely weeded, and brushed clean from leaves; the cottage-doors were painted; and, in short, everything was done that could make our homes more comfortable or more neat; for the fair-day was one of hospitality to all strangers; and to have received them in negligence or untidiness, would have seemed to us the height of ill-breeding. It was a pleasing sight for us boys, when perched upon the cottage roofs, or seated on the bough of some tall tree, to watch the busy preparations which were making for the approaching festivities. Some were employed in partitioning off the village-green into square divisions for the cattle: some were erecting booths for sweetmeats and toys, and some were fixing swings and round-abouts; while in another part of the green the village authorities were in earnest conversation with mountebanks, showmen, conjurers, and fruit-sellers, respecting the price which each should pay for a certain space of ground. No statesmen, settling a treaty between nations—no warriors, inspecting the field of an approaching battle, could look more serious and sedate than these: if their very lives had depended on the termination of the conference, they could not have looked more grave. The heads of some were moving from side to side; the heads of others were moving up and down; some grasped their pockets convulsively, and turned on their heels; some curled their lips and counted their fingers: in short, a careful observer, placed far enough away to be out of hearing, but still within sight, might have seen depicted in their ever changing gestures, all those varieties of feeling which are manifested in the course of mercantile transactions of the most extensive kind.

Far beyond this busy scene the horizon was clouded with rising dust, caused by the approaching cattle and caravans. In a short time they were distinctly visible, and in the space of a few minutes more, we saw them descend the hill immediately opposite to their place of destination. The cattle galloped and frolicked as if they too enjoyed the approaching festivities; and so perhaps they did, for none of them were tired from long travelling, having merely come from adjoining farms; and if they could be pleased with their own fine appearance, and experience a little of human vanity in being gazed on and admired, they must have felt pleasure indeed: be this so or not, they *did* appear pleased; why I cannot tell. Now came donkies, with gingerbread, fruits, and toys; carts, with mountebank-stages, balancing poles, swings, and round-abouts; then followed caravans with wild beasts, penny-peeps, giants, and dwarfs; next the more humble punchinellos, dog-cart men, and blind fiddlers; who, having allowed the aristocracy of the craft to advance before, now followed in the rear. The bells all the time continued ringing merrily, and thus passed away the evening.

Now I must suppose the night spent; not in sleep, at least, by me, for I was too anxious; however it *was* spent, and the fair-day had arrived, which brings me to the subject of my tale. I am sorry to own, that when young I employed my little stock of scientific knowledge chiefly in playing practical jokes, and this propensity did not entirely leave me until the fair-day, which I am now about to describe. Scarcely waiting to finish my breakfast, I sallied out with some of my young friends in search of adventures, and passing along a row of show-caravans, I was struck with the appearance of a picture, representing a giant and a dwarf, who were to be seen inside, together with a boa-constrictor and an alligator, all for the sum of one penny. Attracted by the harmony of a kettle drum and a cracked trumpet, a larger crowd of spectators surrounded this caravan than any other; and the managers were enjoying in consequence an undue monopoly. The wild-beasts' men in vain bawled forth the names and nations of their wonderful animals. Punchinello jabbered to the empty air, and the mountebanks danced and grimaced in vain; the giant, dwarf, alligator, and boa-constrictor were all the rage; and

the trumpet and kettle-drum drew wondering crowds into the caravan. "I have sartinly seed many a bigger fellow than he," said a countryman, stepping out. "If I beant mistaken," continued another, "the feller is on stilts, and if a body could make un come out upon the ground and show his inches fair and undeceitfully, he would look a wonderful different man." I do not know how it was, but this conversation aroused in me the most pleasurable sensations: I reasoned myself into a belief, that if there was any deceit in the matter, I should act properly in exposing it, by exhibiting the giant in his full proportions. When the mind is bent upon the performance of some mischievous trick, we first quiet conscience by endeavouring to clothe our evil propensities in a garb of virtue;—so was it with me; I fancied, that by drawing the giant out I should exhibit any deceit that there might be; and if there should be no deceit, then the giant might walk in again. But my conscience was not quite satisfied upon this point, inasmuch as the dwarf too must certainly experience some inconvenience if my proposed measure should be carried into execution:—perhaps also the alligator and snake might suffer. However, I had determined that the giant *should* come out, and conscience in vain whispered—no.

Returning home, I selected a basin—provided myself with ingredients for making this disgusting sulphuretted hydrogen, and filling the basin with nuts, the better to disguise my schemes, I crept stealthily under the giant's caravan, where, having set on the preparation of my gas, I retreated as fast as I could, allowing the noxious stench to ascend through the cracked and separated flooring of the caravan. Standing at a little distance on a hillock, I watched the result. "Walk in, ladies and gentlemen," bawled the conductor; squeak" went the trumpet, "bang" went the kettle-drum; but all in vain, the ladies and gentlemen kept walking out instead of walking in; their faces contorted and their notes compressed. Presently the musicians too left their posts, for the stench was intolerable. Another moment, and the ground was cleared for the space of many yards around the caravan; that is to say, all had left it but myself, who, standing on the little hillock, was enjoying a sight of the mischief which I had created. Whilst I was one of the crowd, my ecstacies, for aught I know, might have remained unnoticed; but standing alone they must necessarily have been remarked, and, indeed, so they were. Presently the dwarf gave a convulsive shriek—the giant roared aloud, and bursting from the caravan with the dwarf clinging tightly round his neck, he jumped from the platform to the ground, where heaving his great chest, and staring wildly around, he looked like an infuriated being from another world. Whether irritated by my laughter, or guided by an instinctive sense to the person of his tormentor, I know not, but leaping towards the hillock on which I stood, he snatched me in an instant from the ground.

I now repented of my joke, for he clawed and shook me about as a cat does a mouse;—a sound drubbing I would not have cared so much about, but the monster almost strangled me;—his great hands squeezed me so, that I thought every bone in my body was broken. Cry I could not, for he closed my mouth by main force, in order that I might be tortured with greater effect. He did not strike me, it is true; if he had, I think I must have died; and in this forbearance he was generous, well knowing his own immense strength; but having clawed me for a minute or two, he very coolly held me under one arm, my head towards the ground, and my feet kicking aloft; while the dwarf on his shoulder was busily engaged in belabouring my back and sides with a cudgel; a task which he executed with great perseverance and effect, exerting at every blow his utmost strength: *he* not being at all afraid of breaking my bones. Even this treatment was a relief to me, because I could cry. The people were panic-struck, and what with the horrible smell, and what with fear of the giant, no one came to my assistance; indeed I did not deserve that they should. How the rest of the day passed, I know only from hearsay: feverish and delirious I found myself two days afterwards in bed, surrounded by two doctors and a nurse. Six weeks passed, and I was yet unable to walk from the effects of my squeezes and bruises: however, I suffered no lasting injury, and I have many times since then been thankful that my fondness for practical joking experienced such a timely and salutary check.

From what I have been told, the giant really looked as large outside the caravan as he did inside it, and he did not require the aid of stilts to increase his height. As to his strength, I can offer personal testimony. But the sun has set, and I have reached my abode, therefore good night to you all."

A Treatise on a Box of Instruments and the Slide-Rule, with the Theory of Trigonometry and Logarithms; to which is appended, an easy method of imprinting useful Numbers on the Memory. For the use of Schools, the Mechanic, and the Engineer. By T. Kentish. London, Relfe and Fletcher, Cornhill, 1839.

We can confidently recommend this little Treatise as a valuable acquisition to young geometers; in explaining the use of the different instruments, the elements of several branches of mathematical science are exhibited with remarkable lucidity. As an example, we extract the following concise account of logarithms —a subject too frequently surrounded with a mist of obstruseness impenetrable to the uninitiated:

"Logarithms are a series of numbers in arithmetical progression, corresponding to another series of numbers in geometrical progression: thus—

0	1	2	3	4	5	6	7	8
1	2	4	8	16	32	64	128	256

where the indices 0, 1, 2, 3, &c. in the arithmetical series, are the logarithms of the numbers 1, 2, 4, 8, &c. of the geometrical.

"On examining these, it will be found that if any two of the logarithms, or indices, are added together, their *sum* will be the logarithm or index of the *product* of the numbers to which they belong. Thus, 2 and 3 are 5; the number against this is 32, which is the product of 4 and 8, the numbers beneath the indices 2 and 3.

"In like manner, if any one of the indices be *subtracted* from another, their difference is the index of the *quotient* of the numbers. Thus, 5 from 7 leave 2, the number against which is 4, the quotient of 128 by 32

"For the same reason, if any one of the indices be *multiplied* by another denoting any *power*, the product will be the index of that power. Thus, to find the square of 8; its index is 3, which, doubled, becomes 6, the index of 64, the square of 8, as required.

"Lastly, if the index of any number be *divided* by the index of any *root*, the quotient will be the index of that root. Thus, to find the square root of 16; its index is 4, the half of which is 2, which is the index of 4, the square root of 16, as required. From which it appears that addition of logarithms answers to multiplication of common numbers, subtraction to division, multiplication to involution, and division to evolution. The same will also be the case if we select any other geometrical series; thus—

0	1	2	3	4	5	6
1	3	9	27	81	243	729

or—

0	1	2	3	4	5	6
1	10	100	1000	10,000	100,000	1,000,000

From which it is evident that the same indices may serve for any system, and, consequently, that the varieties of systems of logarithms are infinite."

Trigonometry is treated in an equally brief and masterly manner; and the whole volume is characterized by clearness, brevity, and accuracy. We not only wish but predict distinguished success to the author.

A New Derivative Spelling Book, in which not only the Origin of each Word is given from the Greek, Latin, Saxon, Dutch, French, Spanish, and other Languages, but also their present acceptation, with the parts of Speech accurately distinguished, and the Syllables accented agreeably to the most correct Pronunciation. By J. Rowbotham, F. R. A. S. London: Harvey and Darton, 1839.

It is a prevalent opinion amongst tradesmen and others who depend upon their own exertions for the possession of the comforts of life, and a respectable position in society, that the study of language is an ill-advised loss of time, and its object, if ever attained, of little or no utility in promoting the more important objects of commercial or operative undertakings: a closer examination of the subject must, however, soon convince us that the command of accurate, and consequently pleasing and elegant language, is a matter of paramount importance in almost every transaction in life; in negotiating the most momentous business, and in the courteous expression of conventional civility; in the heat of our quarrels, and in the confidence of friendship and affection; in the house of sorrow, and at the festive board, language must ever be the interpreter of the mind, or the advocate of our cause; we therefore hail with pleasure every successful attempt to facilitate the acquirement of so valuable a treasure. The little volume before us is eminently calculated to create a desire for more learning, and, considering its small dimensions, contains in itself a great quantity of valuable information. The derivation of each word, and the literal meaning of the original words are given. The Greek words are written in corresponding English characters, thus avoiding the necessity

of learning, or referring to the Greek alphabet. A few examples must convince the reader that this mode of instruction cannot fail to impress upon the mind that correct idea of the meaning and force of a word, which is necessary to its proper and judicious application :—

"A′-tom, s. ; *atŏmŏs*, not divisible, from *a*, not, and *tēmnō*, I cut;—a particle of matter so small that it cannot be divided or cut.

"Cyn′-ic, s. ; *kunikŏs*, dog like;—a morose, snarling fellow.

"Mon′-arch (pronounced *mon-ărk*) s. ; *mŏnŏs*, one, alone, or single ; and *archē*, ruler, or governor; a sovereign who is invested with supreme authority."

It must be recollected, that this book is not intended as an introduction to foreign languages, and, accordingly, they are only introduced as connected with, or explaining English words. The Greek and Latin prepositions employed in the composition of English words, will be found a profitable study. The pronunciation of French words and phrases is difficult, and often impossible to express by any combination of letters, according to their sound in English. The sound of the French *je*, which occurs (with an almost imperceptible shade of difference) in the English words *grazier*, *leisure*, &c., is written *sjĕh*, which can hardly suggest so simple a sound. The French *s* and *x* often take the sound of *z*, as *beaux esprits*, *soi-disant*, *vis à vis*, &c., pronounced bo-zes-spree, swah-de-zang, ve-zah-ve; these are written with an *s* instead of a *z*, which produces the effect of an unpleasant German accent. It would exceed our proper limits to discant upon the various contents of this little volume; we therefore conclude by recommending it as, taken altogether, far superior as an elementary book for schools, or as imparting a tinge of conversational erudition to those who have concluded a plain education, to any other work of the kind we have ever seen.

Walks and Wanderings in the World of Literature, by the Author of "The Great Metropolis." 2 vols., post 8vo Saunders and Otley.

As in our frequent search after entertainment, the Author of the "Great Metropolis," has never failed to gratify our taste, we were glad with the invitation to accompany him in further "*Walks and Wanderings in the World of Literature.*" We anticipated a treat, and can assure our readers, we were not disappointed. Our author has enlivened his rambles with such a pleasing variety of useful and entertaining narrative, as cannot fail to make every reader wish his present volumes the same success as his previous works have had.

THE CHEMIST.

ACIDS.

NO. III.

Chloric Acid may be prepared by passing a current of chlorine through a mixture of oxide of silver and water; chloride of silver is produced, which is insoluble, and may be separated by filtration. The excess of chlorine, which the filtered liquor contains, is separable by heat, and the chloric acid dissolved in water remains. Chloric acid may also be obtained by adding dilute sulphuric acid to a solution of chlorate of baryta, as long as it occasions a precipitate. The baryta is thus separated in the form of an insoluble sulphate, and the chloric acid remains in aqueous solution. Care must be taken to add no more sulphuric acid than is requisite, for any excess contaminates the chloric acid. If the exact proportion has been used, the chloric acid is neither rendered turbid by dilute sulphuric acid, nor by chlorate of baryta. If either of these occasion a precipitate, they must be carefully added till the effect ceases ; the clear liquid may then be decantered or filtered off. Chloric acid is a sour colourless liquid ; it forms no precipitates in any metallic solution. It is decomposed by hydrochloric and sulphurous acids and by sulphuretted hydrogen. Its compounds are called *chlorates*.

Chlorocyanic Acid.—If pure cyanuret of mercury in powder is moistened, and exposed, out of the presence of light, to the action of chlorine in a well-stoppered phial, in the course of a few hours bichloride of mercury and chlorocyanic acid are formed. The bottle is then cooled to 0°, by which the chlorocyanic vapour is solidified. Chloride of calcium is introduced, the stopper replaced, and the bottle moderately warmed, that all the water may be absorbed by the chloride. The vapour is then resolidified by a second exposure to the freezing mixture, and in this state the bottle is filled with mercury, and a bent tube properly attached, so that on applying to it a gentle heat, the chlorocyanic acid may be collected in an elastic state over mercury. At 0° it crystallizes in transparent needles, between 6° and 12°, or under a pressure of four atmospheres; at 60° it is a limpid colourless liquid, and

at temperatures above 12°, under ordinary pressure, it acquires the state of permanent vapour or gas, excessively irritating to the eyes and organs of respiration. Water dissolves about 25 volumes of it, alcohol about 100 volumes, and ether about 50; but its solution does not redden litmus when pure, and when free from cyanogen and hydrochloric acid, it does not render turbid a solution of nitrate of silver.

Chromic acid is most easily procured by the decomposition of the native chromate of lead, which may be effected by reducing it to a very fine powder, and boiling it in a solution of potassa or soda. An orange-coloured solution of the alkaline chromate is thus formed, to which sulphuric acid is to be added. On evaporation, crystals of chromic acid are formed along with the sulphate of soda or potash; or the acid may be formed by adding nitrate of baryta to the chromate of potash, and subsequently decomposing the chromate of baryta, which falls by sulphuric acid. Chromic acid is of a dark red colour, its taste is sour and metallic; it tinges the cuticle yellow. It may be obtained from its aqueous solutions in deliquescent prismatic crystals of a ruby colour. It dissolves in alcohol, and the solution gradually deposits green oxide. With muriatic acid it forms a compound which dissolves gold. Its compounds are called *chromates*.

Cinchonic acid may be obtained by boiling the yellow cinchona bark in water acidulated with sulphuric acid, filtering and adding to the warm liquors recently prepared, moist hydrated oxide of lead till they are perfectly neutralized, and acquire a yellow colour. The yellow liquid contains a little cinchonate of lead, a considerable quantity of cinchonate of lime and quina, together with some colouring and extractive matter. The lead is separated from the yellow solution, either by a little sulphuric acid or by sulphuretted hydrogen. The liquor is filtered and the quina precipitated by a very slight excess of lime. What now remains, dissolve in nearly pure cinchonate of lime; it is evaporated nearly to the consistency of a syrup purified by precipitation with alcohol, and decomposed by oxalic acid, added drop by drop. Cinchonic acid furnishes a colourless aqueous solution, which, when concentrated, becomes yellow brown. It is sour and slightly bitter, and difficultly crystalizable. It forms salts called *cinchonites*.

Ferro-chyazic acid may be obtained by dissolving 68 grains of crystallized tartaric acid in alcohol, and pour the solution into a phial containing 50 grains of ferrocyanate of potassa, dissolved in three drachms of warm water; by these means the potassa is precipitated in the state of supertartrate, and the ferro-chyazic acid remains in the alcohol, from which it may be obtained by careful evaporation, in small cubic crystals. It is decomposed by a gentle heat, or strong light, in which case hydrocyanic acid is formed, and a white hydrocyanate of iron is deposited,

Fluoric Acid.—When finely-powdered fluoride of calcium, or fluor spar, as it is usually called, is distilled with twice its weight of sulphuric acid, a highly volatile and corrosive liquid is obtained, which acts powerfully on glass and most of the metals. The retort employed in this experiment must be of lead, as also the receiver. The receiver must be immersed in a mixture of ice and salt. The product is best preserved in a silver bottle, with a well-fitted stopper of the same material. When pure, it is clear and colourless, very volatile, and smokes when exposed to the air; at a temperature above 60°, it flies off in vapour. Its specific gravity is about 1.0609, but by the gradual addition of a certain quantity of water, it acquires a considerable increase of density, the mixture having a specific gravity of 1.25. Its attraction for water far exceeds that of the sulphuric acid, and when dropped into water, it excites a hissing noise, and great heat is evolved. Its vapour is dangerously pungent and irritating, and the liquid acid is eminently active upon the skin, produces a painful sore, and in larger quantities dangerous, and malignant ulceration; hence the vessels containing it require to be handled with the greatest caution. Its most characteristic property is the energy with which it acts upon glass. Its vapours soon destroy the polish and transparency of all neighbouring glass vessels, and when dropped upon glass, great heat and effervescence are produced, and dense fumes evolved, consisting of fluosiliric acid. Diluted with about six parts of water, the acid may be used for etching upon glass, which it very effectually accomplishes in a few minutes. Its compounds are termed *fluates*.

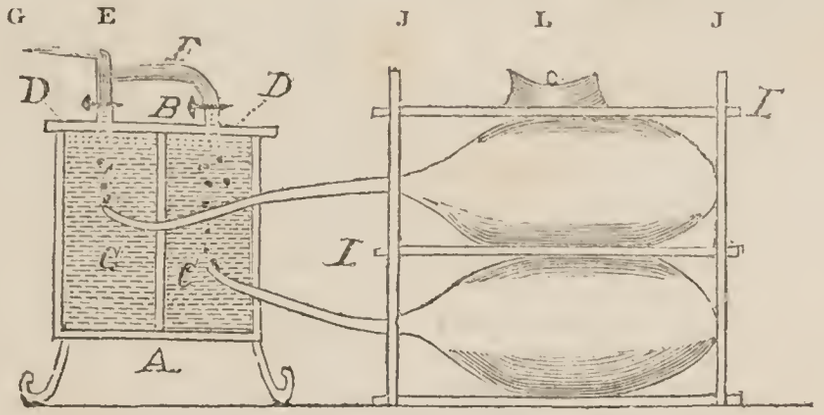
J. Mitchell.

The lovers of English art will rejoice to learn, that David Roberts has returned from his wanderings in the East, laden, as they will be sure, with matter for their future delight.

MITCHELL'S OXY-HYDROGEN BLOWPIPE.

To the Editor of the Mechanic and Chemist.

Sir,—Should you think the following description of an oxy-hydrogen blowpipe, which I have invented, worthy of notice, you will oblige me by inserting it. It has, I think, advantages over those I have hitherto seen. It combines safety and convenience. It can also be applied to the production of the oxyhydrogen light, by projecting the flame on lime. A, is a square metallic vessel, which may be made of sheet iron painted. It is separated in the middle by the partition, B; the spaces, C C, containing water; D D is a double wire gauze, covering the tops of each partitions; E and F are two pipes communicating with each other, as seen in the diagram. The point, G, is the blowpipe jet; H is a square stand, made of



wood; the pieces, I I, slide up in the rods, J J; between the pieces, I I, are placed bladders containing the oxygen and hydrogen; the weight, L, on the top, is for the purpose of keeping up a constant stream of the gases, each of which pass through their separate portion of water, thence through the wire gauze to the pipes, each of which is furnished with a stop-cock, so that the gases are not mixed until the moment of ignition; from whence it will be seen, that explosion is next to impossible; the wire gauze prevents the flame from igniting the large portions of gas in the bladders, and the water affording an additional security. The hydrogen to be turned on first and ignited, then the oxygen.

I remain yours, &c.

J. Mitchell.

ADVENTURE WITH A SERPENT.

A correspondent of the Madras Herald gives the following account of an adventure with a cobra di capello, which occurred to a gentleman who was reposing under a tamarind tree alone, after a day of shooting:—"I was aroused by the furious baying of my dogs: on turning round, I beheld a snake of the cobra di capello species, directing its course to a point that would approximate very close upon my position. In an instant I was upon my feet. The instant the reptile became aware of my presence, in nautical phraseology, it boldly brought to, with expanded hood, eyes sparkling, neck beautifully arched, the head raised nearly two feet from the ground, and oscillating from side to side, in a manner plainly indicative of a resentful foe. I seized a short baboon, left by one of the bearers, and hurled it at my opponent's head. I was fortunate enough to hit it beneath the eye. The reptile immediately fell from its imposing attitude, and lay apparently lifeless. Without a moment's reflection, I seized it a little below the head, hauled it beneath the shelter of the tree, and very coolly sat down to examine the mouth for the poisoned fangs of which naturalists speak so much. While in the act of forcing the mouth open with a stalk, I felt the head sliding through my hand; and, to my utter astonishment, became aware that I now had to contend against the most deadly of reptiles in its full strength and vigour. Indeed I was in a moment convinced of it; for as I tightened my hold of the throat, its body became wreathed round my neck and arm. I had raised myself from a sitting position to one knee; my right arm, to enable me to exert my strength, was extended. I must, in such an attitude, have appeared horrified enough to represent a deity in the hindoo mythology, such as we so often see rudely emblazoned on the portals of their native temples. It now became a matter of self-defence. To retain my hold it required my utmost strength to prevent the head from escaping, as my neck became a purchase for the animal to pull upon. If the reader is aware of the universal dread in which the cobra di capello is held throughout India, and the almost instant death which invariably follows its bite, he will, in some degree, be able to imagine what my feelings were at that moment; a shudder, a faint kind of disgusting sickness pervaded my whole frame, as I felt the cold, clammy fold of the reptile's body tightening round my neck. To attempt any delineation of my sensations, would be absurd and futile: let it suffice, they were most horrible. I had now almost resolved to resign my hold. Had I done so, this tail would never have been written; as no doubt the head would have been brought to

the extreme circumvolution to inflict its deadly wound. Even in the agony of such a moment, I could picture to myself the fierce glowing of the eyes, and the intimidating expansion of the hood ere it fastened its venomous and fatal hold upon my face and neck. To hold it much longer would be impossible. Immediately beneath my grasp, there was an inward working and creeping of the skin, which seemed to be assisted by the very firmness with which I held it; my hand was gloved. Finding, in defiance of all my efforts, that my hand was each instant forced closer to my face, I was anxiously considering how to act in this horrible dilemma, when an idea struck me that, was it in my power to transfix the mouth with some sharp instrument, it would prevent the reptile from using its fangs, should it escape my hold of it. My gun lay at my feet, the ramrod appeared the very thing required, which, with some difficulty, I succeeded in drawing out, having only one hand disengaged. My right arm was now trembling from over-exertion, my hold becoming less firm, when I happily succeeded in passing the rod through the lower jaw up to its centre. It was not without considerable hesitation that I suddenly let go my hold of the throat, and seized the rod in both hands; at the same time bringing them over my head with a sudden jerk, discharging the fold from my neck, which had latterly become almost tight enough to produce strangulation. There was then little difficulty in freeing my right arm, and ultimately throwing the reptile from me to the earth, where it continued to twist and writhe itself into a thousand contortions of rage and agony. To run to a neighbouring stream to lave my neck, hands, and face, in its cooling waters, was my first act after dispatching my formidable enemy."

Improvement in the mode of constructing Steam Engine Boilers.—The *Newcastle Journal* says, we have recently had an opportunity of witnessing the application of an improvement made by Joseph Price, Esq., glass-manufacturer, of Gateshead, in the mode of constructing steam engine boilers, by which, with a consumption of coal, less than one-quarter of that commonly employed, the same quantity of steam was generated. The peculiarity of construction lies in the interior of the boiler, the flue of which is made to pass several times through its entire length, thereby economising the heat, and producing at the same time, a current of air equally strong, as would be caused by a perpendicular chimney of the same length. The boiler, which we saw, was attached to an engine of about ten horse power, with twenty and a half inch cylinder, and was working at about 1½ lbs. pressure to the inch. The consumption of coal averages about two tons weekly, which, with an ordinary boiler, producing the same power, would be somewhere about eight or nine tons. There are other important advantages possessed by Mr. Price's boiler over those in ordinary use, and which recommend it to the attention of scientific and practical men.

Important to Miners.—Professor Graham, at the meeting of the British Association, made an important practical suggestion, which may be the means of saving many lives. He observed that the *after damp*, or carbonic acid, left in the atmosphere of a mine after an explosion, is supposed to occasion, in many instances, a greater loss of life than the explosion; at the same time, it renders assistance impracticable. In many cases the oxygen of the air is not exhausted by the explosion, although, from the presence of five or ten per cent. of carbonic acid, it is rendered irrespirable. The atmosphere will be rendered respirable by withdrawing carbonic acid, and he suggested a method by which this may be effected. He found that a mixture of slacked lime and pounded Glauber salts, in equal proportions, has a singular affinity for carbonic acid; and that air might be completely purified from that deleterious gas by inhaling it through a cushion of not more than an inch in thickness, filled with that mixture, which could be done without difficulty. This lime filter would be an additional source of security wherever the safety lamp is necessary, and it should be invariably employed by persons who descend into a mine to afford assistance to the sufferers.—*The Lancet.*

Eyes of Insects.—The most remarkable arrangement regarding the eyes of animals is observable in the vision of the insect races. In this instance the eye is fixed to the head; whether because there is not room to turn it conveniently, or because another provision is better, is of no consequence. Such is the fact; and see how nature has compensated the want of the moving process. In the common fly, which offers a ready example, are seen two small round projections at the side of the head. These little dull protuberances are not single eyes. Each projection contains many thousands of eyes disposed in rows, each one of which is capable of transmitting an impression of outward objects; and by this means the fly can see as well behind as before, as well down as up, and is therefore put on its guard against attack. A German naturalist counted 6236 eyes in a silkworm. Another naturalist counted 14,000 in a drone fly, and 27,000 in a dragon fly. It has been proved by actual experiment, with the help of microscopes, that each one of these eyes was capable of receiving an independent and distinct impression. The inference seems necessarily to be, that the retina of these insects may receive, at the same time, some thousands of impressions without any confusion; which is far more wonderful than the single impression made on the retina of our own species, and on those of other animals, who have two eyes with a retina for each. The little insect or fly, that skims about so rapidly along pools of water, requires to see both upwards and downwards at once; and so nature has kindly provided for their comfort in this respect, by fitting a portion of their eyes on the upper part of the head, and another portion below; they hence see into the air and into the water at the same time.

Discovery of a Subterranean Chamber at Alton.—A number of labourers have lately been employed by the Earl of Shrewsbury in excavating part of the ruins of the ancient baronial castle, which forms the chief ornament of this picturesque village. Amongst other trifling curiosities

they found some bullets and a piece of ancient coin; but a few days since they discovered a subterraneous apartment and a flight of stone steps, which apparently form a descent to the bottom part of the stupendous and lofty rock on which the castle is built. The excavation has since been suspended by order of the Earl, who intends to continue it to a still greater extent on his return to England next summer.—*Staffordshire Examiner.*

Splendid Viaduct.—The first stone of the viaduct at Congleton, on the line of the Manchester and Birmingham Railway was laid with much ceremony on Wednesday week. In length the viaduct will be 3078 feet, or nearly a mile, 31 feet in width, and 27 feet between the parapets; the span will be 60 feet, with 20 feet rise. There will be 42 arches, which are segments of circles; and the greatest height from the river to the rails will be 98 feet 6 inches. The bases of the piers are intended to be of stone for about twelve feet in height above the ground; the imposts and parapets will also be of stone, and the rest of the structure of brick. The viaduct will contain about 61,000 cubic yards of brick-work, and about 586,000 cubic feet of stone-work, and is expected to be completed in two years and a half.

A Thunder Storm on the Summit of Loch Lomond.—About two hours before sunset, the sky, which was formerly unclouded, became suddenly overcast. Shortly after, a scene ensued of the most terrific kind: but few such scenes could ever have been witnessed in Europe. We found ourselves above the region of the clouds: they floated in the atmosphere beneath, and hovered over the surface of the mountains; anon succeeded a vivid flash of lightning, which was instantly followed by a peal of thunder, louder and more protracted, perhaps, than ever was before or since heard on British ground. Again and again, in forked and brilliant sheets, did the electric fluid flash; and again and again did the thunder peal, till its reverberations among the mountains seemed to us as if they had been the prelude to the disorganization of Nature herself. Our courage, I am free to confess, forsook us; we stood aghast at the appalling scene; we then felt, for the first time, the utter insignificance of man: we felt, moreover, as if we had been alone in the world. Happily, the elemental strife, after raging with such violence for about half an hour, began to subside, and we hastened to descend the mountain, seeking to calm our yet troubled spirits in the nearest house.—*Walks and Wanderings in the World of Literature, by the Author of "The Great Metropolis."*

An India-rubber Boat.—There has been just launched on the Neva, says a St. Petersburgh letter, an India-rubber boat. It is made of sail-cloth impregnated with caoutchouc. It may be rolled up, and in the space of ten minutes can be filled with air by means of four little cocks, by which inflation it assumes the form of a boat. During its trial on the river it held three persons, and excited much attention as well by the readiness of its movements as by its pretty appearance.

Wreck of the Royal George.—Immense quantities of the wreck of this vessel have been picked up since the great explosion of the cylinder containing 2,600 lbs. of gunpowder, the force of which is expected to have almost shattered the wreck to pieces. On Tuesday the mainmast was picked up by the pilot of the look-out vessel belonging to the *Netherlands Consul*, moored at Spithead, who conveyed it to the dockyard at Portsmouth. It has a most extraordinary appearance, and has excited very great curiosity. It is entirely covered with barnacles, all alive, some measuring eight inches in length.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 16, Rev. R. Vaughan, D.D., on the History and Antiquities of Athens. Friday, Oct. 18, T. Walker, Esq., B. A., on Astronomy. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 16, Quarterly General Meeting. At half past eight.

QUERIES.

1. In the making of water-colours, how are they formed into square cakes and stamped? 2. How to make Frankfort black? 3. How to make infusion of gentian, as it it sold in the chemists' shops? F. J. F.

How to melt brass in quantities of about an ounce to cast in moulds? I have tried several ways and have failed. G. G.

How to make red and green fire?
G. R. C.

How to take stains out of crimson silk?
F. J. T.

What materials are wanted to commence a brass foundry with? Can you give me a drawing how to build a furnace? How to melt brass on a small scale? Which is the best way to make a dividing plate for cutting tooth wheels?
R. Cotton.

1. How to varnish plaster figures, so that they may be washed? I have seen some look like marble. 2. How to clean and polish shells? 3. How to prepare paper for painting on in oil? 4. The best way to take out rust and stains from polished steel articles? T. H.

The way in which a true ball or globe can be turned? H. S.

How to make carbonic acid gas? An early answer will much oblige A Subscriber.
9, Ernest-street, Regent's Park.

ANSWERS TO QUERIES.

To Remove Warts—"Alpha." Mr. Tyrrell in his lectures on astronomy recommends the application of a strong decoction of the root of the septfoil to cure warts, particularly when situated in parts of delicate structure, by destroying there peculiar vitality. For making the decoction

he recommends the following directions:—Boil gently an ounce of the fresh root of the aquilon, bruised in twelve ounces of water, till reduced to half a pint, and then strain off the liquor for use. After washing the warts with warm water three times a day, they must be kept constantly covered with lint moistened with the decoction.

P. T.

Hydrogen Gas.—"Alpha." Take a retort furnished with a glass stopper above, and put into it an ounce of iron filings, such as may be procured at any smith's or artisan's workshop; add to this four ounces of water, and then pour in four ounces of sulphuric acid. An action immediately commences between the substances, and a bubbling of air is perceived; this is hydrogen gas, which, if the glass stopper is put in, will pass over by the mouth of the retort, and may be collected by means of jars. If a retort is not at hand, a simple apparatus still may be used, such as a strong phial with a wide mouth, into which put the ingredients as above, and then fix a glass tube into a cork and put it into the phial; the gas will escape by the tube, and may be collected by tying a bladder on it; or if the tube is bent like the letter S, it may be used in the air trough. If a taper be put to the end of the glass tube, after the mixture has been some time in the phial, the hydrogen will inflame, and continue to burn as long as the action within continues; as a mixture of hydrogen and common air explodes with some force, care should be taken that no common air remains in the bottle when the taper is put to the tube; and as a further security, the whole apparatus of the bottle should be rolled round with a coarse cloth.

P. T.

To Stain Ivory.—"J. Herrett." Ivory is stained a scarlet colour by boiling it in lime-water with brazil wood.

To Bronze Plaster Busts.—"W. M. B." will find several methods to effect his purpose in No. 100, Old Series. PROPERTIO.

Sulphate of Soda may be formed by the direct combination of sulphuric acid with soda. It is abundantly procured by the manufacture of muriatic or hydrochloric acid:—2 lbs. of dried muriate of soda (common salt), 20 oz.; sulphuric acid; distilled water, 1 pint. First mix the acid with half a pint of water in a glass retort; add to these when cold, the muriate of soda; pour the remainder of the water into the receiver, adapting the retort to it, and distil by heat. What is left is sulphate of soda. F. PRICE.

TO CORRESPONDENTS.

W. L. S.—*Homœopathy is derived from the Greek* ὅμοιος, *like, and* πάθος, *a suffering or feeling. It is so called on account of a pretended discovery that the cause of every disease is also its cure.* Πάθος, *in the stoic philosophy, also signified mental perturbation, contrary to reason; to this term it may be properly applied to the Homœopathists, for a more arrant piece of quackery was never imposed upon the credulity of man.*

Tyro Chemicus *will find a letter addressed to him at our office.*

J. T.—*The wax crayons are composed of pipe clay, or very fine white chalk, called French chalk, mixed with the required colour, and formed into the proper consistence with virgin wax, and, perhaps, a small quantity of turpentine, which will afterwards evaporate. The moist water-colour appears to be composed of animal gelatine, thickened with acid, as is practised in the manufacture of paste blacking.*

X. S.—*The Royal Society of London is the most timid, inert, and inaccessible of all similar societies in Europe. The value and sincerity of their praise may be estimated by their own declaration, which is as follows:—"It is an established rule of the Society, to which they will always adhere, never to give their opinion, as a body, upon any subject, either of nature or art, that comes before them. And, therefore, the thanks which are frequently proposed from the chair, to be given to the authors of such papers as are read at their accustomed meetings, or to the persons through whose hands they received them, are to be considered in no other light than as a matter of civility!"*

A Correspondent.—*Freezing mixtures are variously formed, and of various powers; the following may probably answer his purpose:—*

Muriate of Ammonia	5	*Thermom.*
Nitre	5	*sinks from*
Water	16	50° *to* 40°.
Muriate of Lime	3	32° *to*—50°.
Snow	2	
Diluted sulphuric acid	10	—68° *to*—91°.
Snow	8	

The sign—signifies below zero.

A. Z.—*It is supposed by some, that the crackling noise which is heard upon bending pieces of tin, is produced by a portion of arsenic being contained in the tin; but recent experiments have shown that this is not the case. Tin, when broken, exhibits a grained or fibrous texture, and may also be granulated by agitation at the time of its transition from the fluid to solid state: the cause of the noise, is clearly a partial internal rupture, or rubbing of particles imperfectly united.*

We are still in arrears with our correspondents, but they shall have our earliest attention.

A SPLENDID RAILWAY MAP!

With the MECHANIC AND CHEMIST of October 26th, will be presented (gratis) a

SPLENDID MAP OF ENGLAND AND WALES; showing, in addition to all the Principal Towns, the routes of the Railways through the various Counties; forming a handsome Frontispiece to Vol. IV. To ensure early impressions, give immediate orders to your Booksellers or Newsmen.

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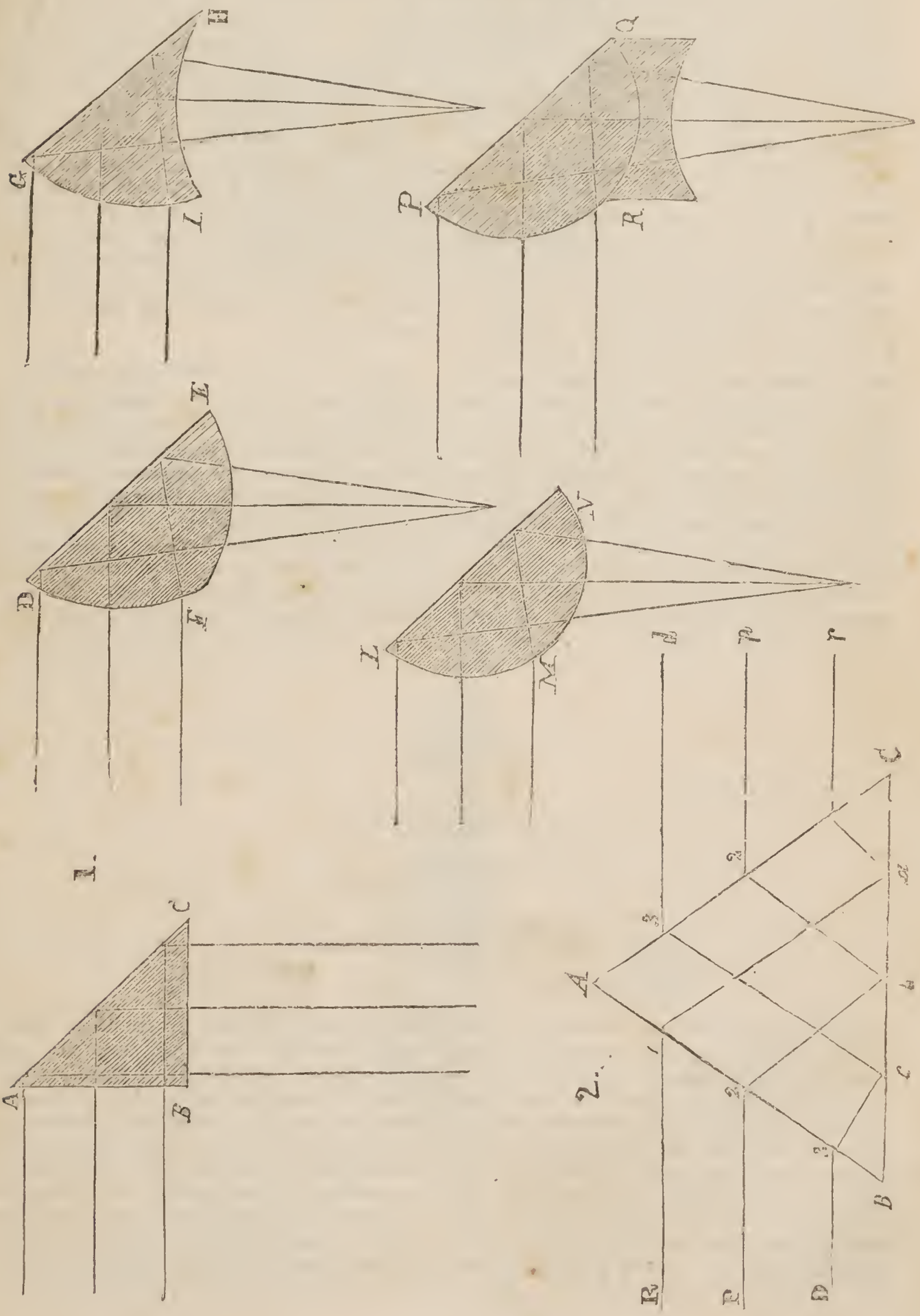
OPTICAL INSTRUMENTS.



VOL. V.—Nos. 6 & 7.] City Press, 1, Long Lane, Aldersgate Street : D. A. dney

OPTICAL INSTRUMENTS.

NO. IV.

ON SIMPLE AND COMPOUND PRISMS.

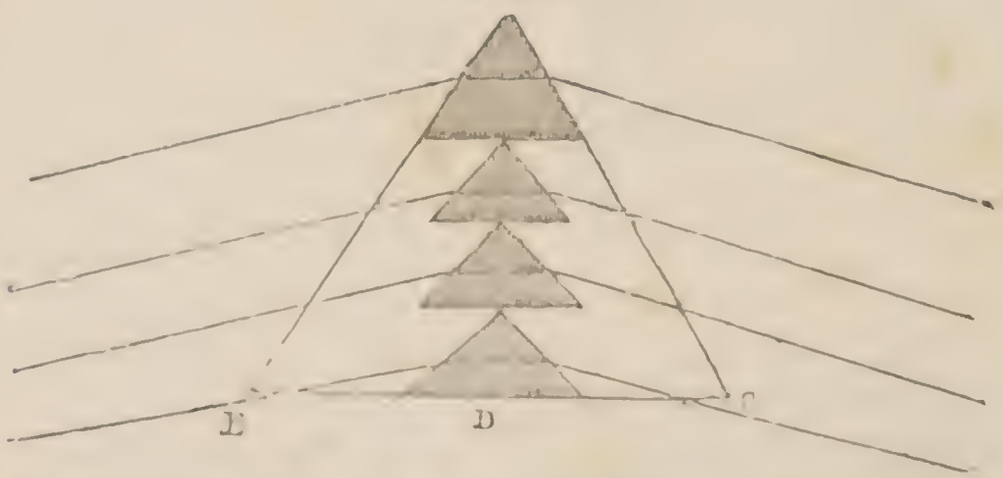
(See Engraving, front page.)

A RECTANGULAR prism, A B C, fig. 1, was first applied by Sir Isaac Newton as a plane mirror for reflecting to a side the rays which form the image in reflecting telescopes. The angles, B A C, B C A, being each 45°, and B a right angle, rays falling on the face, A B, will be reflected by the back surface, B C, as if it were a plane metallic mirror; for whatever be the refraction which they suffer at their entrance into the face, A B, they will suffer an equal and opposite one at the face, B C. The great value of such a mirror is, that as the incident rays fall upon A C at an angle, A C, at an angle greater than that at which total reflection commences, they will all suffer total reflection, and not a ray will be lost; whereas in the best metallic speculum, nearly half the light is lost. A portion of light, however, is lost by reflection at the two surfaces, A B, B C, and a small portion by the absorption of the glass itself. Sir Isaac Newton also proposed the convex prism, shown at D E F, the faces D F, F E, being ground convex. An analagous prism, called the *meniscus prism*, and shown at G H I, has been used by M. Chevalier, of Paris, for the camera obscura. It differs only from Newton's in the second face, I H, being concave instead of convex. On account of the difficult execution of these prisms, Dr. Brewster proposed to use a hemispherical lens, L M N, the two convex surfaces of which are ground at the same time, when a longer focus is required, a concave lens, R Q, of a longer focus than the hemisphere, P R Q, may be placed or cemented on its lower surface, and if the concave lens is formed out of a substance of a different dispersive power, it may be to correct the colour of the convex lens. A single prism is used with peculiar advantage for inverting pencils of light, or for obtaining an erect image from pencils that would give an inverted one. This effect is shown in fig. 2, where A B C is a rectangular prism, and B P D a parallel pencil of light, which, after being refracted at the points 1, 2, 3, of the face A B, and reflected at the points *a b c* of the base B C, will be again refracted at the points 1, 2, 3, of the face A C, and move on in parallel lines 3 *d*, 2 *p*, 1 *r*; the ray, B 1, that was uppermost, being now undermost, as at 1 *r*.

COMPOUND AND VARIABLE PRISMS.

The great difficulty of obtaining glass sufficiently pure for a prism of any size, has rendered it extremely difficult to procure good ones; and they have therefore not been introduced, as they would otherwise have been, into optical instruments. The principal upon which polyzonal lenses are constructed, is equally applicable to prisms. A prism constructed like A D, fig. 3, if properly executed, would have

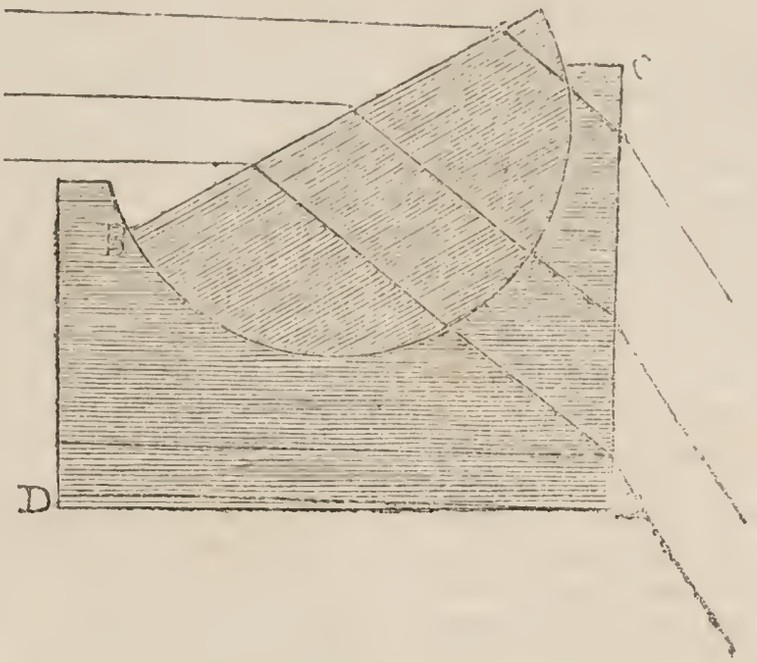
FIG. 3.



exactly the same properties as A B C, and would be incomparably superior to it, from the light passing through such a small thickness of glass. It would obviously be difficult to execute such a prism as A D, cut out of a single piece of glass, though it is quite practicable; but there is no difficulty in combining six small prisms all cut out of one prismatic rod, and therefore necessarily similar. The summit of the rod should have a flat narrow surface parallel to its base, which would be easily done if the prismatic rod were cut out of a plate of thick parallel glass. The separate prisms being cemented to one another, will form a compound prism, which will be superior to the common prism for all purposes, in which it acts solely by refraction. A compound prism of a different pencil, and having a variable angle, was proposed by Boscovick, as shown in fig. 4, where A B C is a

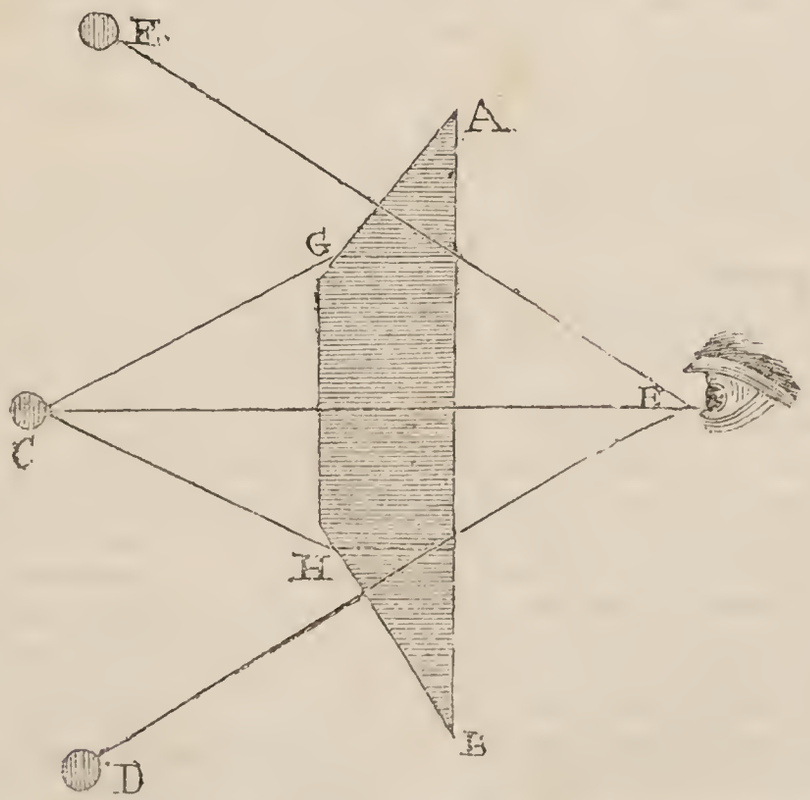
hemispherical convex lens, moving in a concave lens, D E C, of the same curvature. By turning one of the lenses round upon the other, the inclination of the faces, A B, D E, or A B, C E, may be made to vary from 0° to above 90°. As this apparatus is both troublesome to execute and difficult to use, I have employed an entirely

Fig. 4.



different principle for the construction of a variable prism, invented by Dr. Brewster, and have used it to a great extent in numerous experiments on the dispersive powers of bodies. If we produce a vertical line of light, by nearly closing the window-shutters, and view the line with a flint-glass prism, whose refracting angle is 60°, the edge of the refracting angle being held vertical, or parallel to the line of light, the luminous line will be seen as a brightly-coloured spectrum, and any small portion of it will resemble almost exactly the solar spectrum. If we now turn the prism in the plane of one of its refracting faces, so that the inclination of the edge to the line of light increases gradually from 0° up to 90°, when it is perpendicular to the line of light, the spectrum will gradually grow less and less coloured, exactly as if it were formed by a prism of a less and less refracting angle, till at an inclination of 90°, not a trace of colour is left. By this

Fig. 5.



simple process, therefore, namely, by using a line of light instead of a circular disc, we have produced the very same effect as if the refracting angle of the prism had

been varied from 99° down to 0°. Let it now be required to determine the relative dispersive power of flint glass and crown glass. Place the crown glass prism so as to procuce the largest spectrum from the line of white light, and let the refracting angle of the prism be 40°. Then place the flint glass prism between it and the eye, and turn it round as before described, till it corrects the colour produced by the crown-glass prism, or till the line of light is perfectly colourless. The inclination of the edge of the flint-glass prism to the line of light being known, we can easily find the angle of a prism of flint glass which corrects the colour of a prism of crown glass, with a refracting angle of 40°.

MULTIPLYING GLASS.

This lens is more amusing than useful, and is intended to give a number of images of the same object. Though it has the circular form of a lens, it is nothing more than a number of prisms formed by grinding various flat faces on the convex surfaces of a plano-convex glass, as shown in fig. 5, where A B is the section of a multiplying glass, in which only three of the planes are seen. A direct image of the object C, will be seen through the face G H, by the eye at E; another image will be seen at D, by the refraction of the face H B; and a third at F, by the refraction of the face A G; an image being seen through every plane face that is cut upon the lens. The image at C will be colourless, and all those formed by planes inclined to A B, will be coloured in proportion to the angles which the planes form with A B. Natural multiplying glasses may be found among transparent minerals, which are crossed with veins oppositely crystallized, even though they are ground into plates with parallel faces. In some specimens of Iceland spar, more than a hundred finely-coloured images may be seen at once.

A. D. M.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 382.)

AFTER passing under a bridge which carries the road from Leighton to Linslade, and proceeding through an excavation about a mile long and fifteen feet deep, we arrive opposite to Stock Grove, the seat of Colonel Hanmer; the canal flows close to the embankment, and the view obtained from this point is worthy of notice. The line now recedes from Bedfordshire, which county it approaches within about half a mile at the Leighton Buzzard station.

BEDFORD is an ancient borough town, 50 miles from London, and 23 from the Railway station; straw plait and lace are manufactured here, and the trade in corn and coal is facilitated by the river Ouse, which passes through the town. The town consists of one principal street about a mile in length, with many smaller streets crossing it at right angles. The opposite shores of the navigable river Ouse, are connected by a handsome stone bridge of five arches. Bedford has suffered much at different periods from the civil wars with which this country was formerly afflicted; it was more than once the site of cruel battles between the Danes and Saxons. It was besieged in the wars of the Barons, and of the revolution, and was alternately in the possession of each party —may the wisdom of succeeding generations preserve the land from civil discord!

The castle which formerly stood here is so completely destroyed, that a portion of the intrenchments is all that remains to corroborate tradition. The church, dedicated to St. Paul, is a spacious building, partly in the ancient, and partly in the florid or decorated style of architecture. It has a tower with an octagonal stone spire. There is an old chapel in this town, in which John Bunyan, author of "The Pilgrim's Progress," formerly preached: his chair is still preserved. Bedford formerly contained the tomb and chapel of Offa, king of East Mercia, a gentleman celebrated for his piety, and his munificence to the church; and, *per contra*, the kidnapping and murder of his brother saint, Ethelbert. Both tomb and chapel are now lost, being swept away by the encroachments of the river Ouse, which gradually undermined their foundation. Bedford gives the title of Duke to the Russel family. A market is held on Monday for cattle, and Saturday for corn and provisions; fairs, first Tuesday in Lent, April 21, July 5, August 21, October 11, and December 19. Races, September 27, two days. Alternate cuttings and embankments, with some interesting scenery from the latter, brings us to

THE BLETCHLEY STATION, an intermediate one, 46¾ miles from London, and 65¼ miles from Birmingham. Quitting the Bletchley station, the Railway proceeds upon an embankment, and crosses the great Holyhead road, by a massive brick and iron bridge, called the Denbeigh Hall Viaduct. This "Denbeigh Hall," which is no more than a miserable road-side public house, was dragged into notoriety by a temporary station and terminus of the Railway being established there,

before the whole line was completed. A journal of that time says, "It never, within the memory of man, was a coaching house, nor are there any proofs that the beauty of the bar-maid, or the soundness of the ale, ever induced any particular coachman to pull up there. Occasionally, a heavy broad-wheeled waggon or two might be seen standing before it, and it had a sort of minor fame among drovers." The circumstance from which the title of "Denbeigh Hall" originated, is almost as frivolous as the events which sometimes lead to the dubbing of men with equally applicable titles:—Many years ago, the carriage of a fine old gentlemen, a Lord Denbeigh, happened to stick in the mud in one of the fine old roads which abounded in those days. His Lordship took refuge in a neighbouring cottage, and at his departure bestowed a liberal reward upon his host; from that time, Ralph's hovel became "Denbeigh Hall." From the Bletchley station, the road is carried on a lofty embankment, affording a good view on both sides; to the west is the village of Bletchley, situated about a mile from the station. The church is an ancient structure, standing on an eminence, and approached by a noble avenue of yew trees. It contains several ancient tombs and inscriptions, which, though they convey no information of any utility, may afford much amusement to the antiquary. The view to the east discovers the villages of Great Brickhill, and Little Brickhill, and Bow Brickhill church, standing on the highest ground in the county of Bedford, being 683 feet above the level of the sea. It is surrounded by a delightful country, well furnished with wood. After passing the villages of Loughton and Bradwell, we arrive at

The Wolverton Station, 52½ miles London, 59¾ from Birmingham. This is the only station at which passengers are permitted to stop for refreshment between London and Birmingham. There are extensive workshops and foundries erected at this place for the construction of boilers, engines, carriages, &c., and for the repairs which are frequently required in the carriages or machinery when performing long journeys.

A GAMBLING ACADEMY.

Translated from the French for the "Mechanic and Chemist."

I met one day, says M. Decremps, in a coffee-house in London, a Frenchman, named Kussel, with whom I had formerly been acquainted at school. After the usual compliments, I asked him how he spent his time in London; he replied that he passed almost the whole of his time at the Academy. "I congratulate you with all my heart," said I, "and wish I had that happiness myself." "There is no great happiness in it," said he, "but, nevertheless, if you desire to become one of our companions, I could introduce you, and, presented by me, you would be received with open arms." I told him I had no claim to admission into an assembly of that kind; but he explained, smiling at my mistake, that the assembly into which he proposed to introduce me, was not a learned or literary society, but simply an academy of gaming, composed of swindlers of every species, who were alternately cheating and cheated. "Do not imagine," he added, "that I trouble myself about books as I did at college. Since I consigned my library to the flames, I have wandered about, earning a precarious living by every scheme and contrivance which my ingenuity could suggest. I was a butter merchant in Flanders, an actor in Brabant, scrivener, Latinist, and orthographist at Edinburgh, and fencing-master and teacher of music in Dublin. At present, after having changed my trade for the tenth time, I '*fais sauter la coupe**,' draw the card, inveigle the snipes, and pick the pigeons. In a word, if you desire to be initiated into my secrets, and serve me as a confederate at the Academy, you may soon say with me,

"My pocket is a treasure;
Under my happy hands, copper becomes gold."

I was as much shocked as surprised at the liberty he took in making this offer, and the boldness with which he boasted of his dishonest deeds; but such is the blindness of brazen-faced vice, that it often makes men boast of things which ought to make them blush. I replied, that I had long since learnt the theory of his art, not to put it in practice and to make dupes, but out of curiosity, and with the intention of one day denouncing to the public the various snares which are laid to entrap honest people.

"Since you are so knowing," said he, "perhaps you can explain to me how it happens, that for the last fortnight I have constantly lost my money, notwithstand-

* This and the following are terms used by swindlers; "faire sauter la coupe," is a method of secretly replacing the cards in their former position, after they have been cut, or separated into two parcels.

ing the tricks I have practised, and am obliged to appear less frequently at the Academy, and to walk about, not to gain an appetite, but to beguile my hunger."

"It is not surprising," said I, "that you have been beat in your turn; cheats in gaming are like duellers; sooner or later they find their masters: there is, however, this difference, that professed fighting bullies recognize a certain point of honour, which prevents them from fighting two or three against one, while black-legs (*chevaliers d'industrie*) are often a dozen to devour one victim, and divide the spoils of the simpleton who is caught in their nets. One ingratiates himself with the servants of the house, and induces them to substitute marked cards for the ordinary ones; the occupation of another is to invent new snares, and entice the dupes by fair promises; a third manufactures all kinds of cards which may be recognized by the eye or the touch; some are made narrower or shorter than the others; some rougher, smoother, or of a different tint, by rubbing them with different substances; a fourth is continually exercising himself in making 'sauter la coupe,' false shuffling, and '*filer la carte*,' that is, to deal the second or third card instead of the first, when he perceives by some external mark, that the first card is a good one for him they intend to ruin. Another is placed opposite his confederate, behind the victim, to perform what they call the 'little service.' Expert in the art of signals, he changes at every instant the position of his fingers, to let his accomplice know the cards which he could not distinguish by sight or touch. Another, '*tirant la bécassine*' (drawing the snipe) associates himself with his intended dupe; plays against a third with whom he has an understanding, loses all his money, and affects the agony of despair, while he secretly rejoices in the anticipation of the portion of the plunder he is afterwards to receive. A *controleur* is appointed to keep account of the money which the receivers put in their pockets, to prevent them from cheating their confederates; this one makes a false statement for a promised bribe, and the player cheats him in return by keeping all the money himself." Kussel soon perceived that I knew too much to require his lessons, and, at the same time, that I was too honest ever to put them in practice; nevertheless, upon his entreating me to accompany him for an instant to the academy, for the purpose of discovering the artifices which had been employed against him during the last fortnight, the proximity of the place where the assembly was held, and my desire to gain information, induced me to accept his invitation. We found assembled in the same place, noblemen, grooms, musicians, conjurers, tailors, and apothecaries. These gambling houses, said I to myself, are like tombs, all ranks are confounded; at the same time my conductor whispered to me the names and conditions of the persons who composed the assembly. "There in a corner," said he, "are the four persons who have won my money; two of them are great seigneurs *incognito*." They were playing at a game called *brelan*; and what was my surprise, when I recognized in one of the pretended "noble lords," a famous conjurer called *Pilferer*, whom I had known at the Cape of Good Hope. "He is," said I, "no doubt, the person who has won your money." "That nobleman," he replied, "so far from winning anything, loses very good-humouredly every day forty or fifty pounds." Being, however, persuaded that a conjurer would not go to a gambling house to lose his money, I conceived there must be some deep-laid plot, which I had, perhaps, never imagined. I therefore resolved to observe Pilferer, and placed myself near him, with my handkerchief carelessly held up to my face, that he might not know me; I soon remarked, that when he dealt the cards, one person had a *petit brelan*; but there was sometimes a greater brelan in the hand of another player, whose countenance appeared not unknown to me. I soon recollected that I had seen him in Africa serving Pilferer as domestic, companion, and confederate. I immediately suspected that Pilferer dexterously made his confederate win, and affected to lose some trifle himself, in order to prevent suspicion; that the confederate, for the same purpose, never shuffled the cards himself, but allowed others to do it; and that Pilferer and his accomplice pretended not to know each other, to prevent the suspicion of any unfair conspiracy. It remained for me to discover the means which Pilferer employed to deal out good or bad cards, according as it suited his purpose. This discovery did not appear very easy, when I found that he did not substitute a second pack of cards, and before shuffling himself, he always gave them to some other player to shuffle; I, however, at last perceived, that before he gave them to other players to shuffle, he retained five or six cards in his right hand, and receiving back the pack to shuffle in his turn, he placed them adroitly, so as to make his accomplice

win. The reader will perhaps imagine, that this arrangement is impossible; but, like many other tricks which are practised by gamblers, it is but too certain and easy to those who are experienced in the vile practice. I do not describe the means they employ, because I pretend to warn my readers that there exists a dangerous art, of which they may become the victims; but I will teach no one the method of reducing it to practice. I am not combating a chimera, for I have often shown my friends the many false shuffles which may be adroitly and imperceptibly practised at piquet, brelan, and triumph; beyond this, I disclose the secret to no person whatever, and am contented to show the results which prove how imprudent it is to risk money at play with persons whose probity is not perfectly known.

As I was about to retire, Kussel entreated me to communicate to him the result of my observations; but I told him I should not risk embroiling myself in any unpleasant quarrel, by making it appear that I had gone there in the capacity of a spy, and by denouncing facts which would probably be contradicted by many of the persons present; I added, that I only desired to warn the public of the tricks which are invented from time to time to impose upon the unwary; and that after this notice, we may say to the dupes who complain of being cheated, and to the cheat who meets with a cheat and a half:—"*Perditio tua ex te*" (you are the cause of your own undoing.)

As I was going out, I found, in a kind of anti-chamber, two Italians who were speaking in the provincial dialect, in order that they might not be understood; one complained that game was very scarce; the other replied, that it was not surprising, since there were so many sportsmen. "You are right," replied the first, "I played at piquet the other day with a man who had the appearance of an imbecile or an awkward clown, and he was perhaps the cunningest fox in all Europe; during a full hour, I employed against him all the resources of my art, when at last I discovered by chance, that he was employing the same, and deeper tricks against me.

"Corsairs contre corsairs,
Ne font, dit on, leurs affaires."

(When corsairs against corsairs strive,
Their business can never thrive.)

SMUGGLING EXPEDIENTS.

At Folkstone, the focus of the fair trade, boats were fitted with hollow masts and outrigging, having a plug at the upper or outer end. A few fishing-lines or nets were put into such boats as a blind, the owner launched off, went to his cargo, drew up one or two tubs, decanted them into the hollow spars, re-stepped his masts, rowed boldly on shore, suffered his boat to be searched as usual by the blockade sentinel, then hauled her above high-water mark, turned her bottom up, and, carelessly shouldering the masts, according to the universal practice, trudged off, as it seemed, merely to lock them in some place of security, but, in reality to empty and dispose of their liquid contents. One man has been known to make five such expeditions daily, bringing on shore three half-ankers at each trip, thus averaging fifteen tubs, or forty-five gallons per day, and as several boats were so employed, the importation proceeded rapidly, till the secret was betrayed by a drunken smuggler; when a general search was made along the coast, and no less than eleven boats were seized in one day, the whole of which were forfeited, for having such places of concealment contrary to act of Parliament. This device being defeated, another was planned by a Jew, nicknamed Buffy, who was, and possibly is still, a very active agent in all these illicit transactions. Some hundred of tubs were prepared at Boulogne, their shape and colour being altered and disguised by a coating of Paris plaster, studded here and there with gravel, shells, or sea-weed, so that they resembled lumps of chalk, such as are found under cliffs upon the coast of Kent. A cargo of spirits, in tubs of this description, was carried across to Dover during the night, and dropped upon the sands above low-water mark, so as to be dry when the tide receded. The boat then put off to sea and disappeared; and soon after day-break one of the smugglers, attired in a carter's gaberdine, with a long whip upon his shoulder, drove carelessly past the blockade sentinel, proceeded down across the sands, and leisurely loaded his cart with what seemed lumps of chalk, intended for burning into lime; he then laid a few pieces of real chalk over the top, drove again past the sentinel into the fields, where the cart was unloaded in a twinkling, and the operation repeated, till every cask had been conveyed to a place of safety. As no boat appeared in this affair, and but one person attended the cart, there was nothing in the least likely to attract attention, or to excite the suspicion of the

sentinel. The scheme accordingly succeeded so well, that it might have escaped detection altogether, had not the secret been entrusted to a woman! Alas! that we should be compelled to record a circumstance so confirmatory of the freemason's prejudice—so hostile to the credit of the fairer sex—so derogatory to the dear, delightful, unretentive darlings; but we have a solemn duty to perform—truth is omnipotent and woman weak; yet

"Should to her share some trivial errors fall,
Look to her face, and you'll forget them all."

One of the Dover smugglers, in the exultation of success, confided their stratagem to his sweetheart, and the damsel in turn betrayed it to a more favoured lover, who happened to be an officer in the coast blockade service. This of course led to a discovery and seizure of the next cargo, and two of the plastered tubs were immediately sent along the whole line of blockade, to put the officers and sentinels upon their guard against any repetition of the stratagem.—*United Service Journal.*

ON BRIDLING AND BITTING HORSES.

(From the Life of Maccroni.)

A GREAT error which is now common with most horsemen and drivers (not military) is in the use of the bit. The bit is intended and constructed so as, with the assistance of the curb chain, to form a powerful lever, acting on the lower jaw, while the arch of the cross piece presses with violence against the roof of the mouth. For this purpose the curb chain must be sufficiently tight to keep the check pieces of the bit in a straight line with the line of the horse's face, when the arch of the cross piece will be in the same line, and not touch the roof of the mouth; but if the curb-chain be left too slack, the arch piece is always tormenting the roof of the mouth; and when the bridle is pulled, instead of acting on the chain and lower jaw, the checks of the bit come back on a line with the bridle, so nothing further than the action of a snaffle is produced by a bit a foot long. Thus it is that we every day hear of horses running away, "shocking accidents," fractured skulls, &c. Not so with the Turks, Arabs, South Americans, and those people who are the most celebrated in the management of horses. Talk to any of these of a horse running away with them they would not understand you, because they understand how to bridle a horse. It is a mistake to suppose, that by putting on the bit and curb chain as it ought to be, that therefore it is unpleasant and "hard" upon the horse's mouth. On the contrary, the bit is then kept steady, without the arch fidgetting the roof of the mouth. The rider is not bound to bear upon the bridle; but when he does pull the horse must obey. We all know how the Turks and Arabs will gallop up to you, or to a wall, and in the space of a yard or two stop their horse, stiff on all four legs, as though he had been suddenly turned to stone. I have been led into these remarks upon bits and stirrups principally by recollecting that Col. Taylor, shortly after I saw him at Naples, lost his life in Portugal at the battle of Vimeria (I think) entirely owing to the false arrangement of his bit. While gallantly heading a charge against the French, his horse leaped a ditch, or took to a pace which very few of his men could follow. He thus found himself almost alone, within a hundred yards of the enemy. All might yet have been well with him, had he been able to stop and turn his horse; but his bridle had no power; he was seen to pull it with all his might, without any effect; his horse carried him straight into the enemy's ranks; and they not knowing his dilemma, received him on the point of their lances or bayonets, so that he was killed. The kind of horse he rode, too, was not that fitted for war. It was a regular "hunter," long backed, necked and legged, full sixteen hands high—very different from the compact built horses now in use in the British cavalry. If I may be allowed to suppose it possible for Colonel Taylor to be thinking of any such matters during his fatal unwilling course towards the lances of the French, and it is most likely that he did think of bitts—and curse them too—most likely he thought of me at that dire moment. I had been in company with him at Naples, and held with him the conversation on bits and stirrups to the effect which I have here described.

While on the subject of horsemanship and bridles, I will take the opportunity of suggesting some other items to the consideration of such of my readers as are not irrevocably wedded to everything in usuage, merely because it is a usuage, and an old one, perhaps, into the bargain. In consequence of my habits of observation, I am of opinion that the use of "blinkers" to draught horses is more calculated to cause the evils intended to be guarded against. We prevent the horse from seeing in any other direction but straight before him, lest he should be frightened by some object on either side of him. I do

not understand the *rationale* of this. He is as likely to see, to him, alarming objects in front as any where else. Anything new in shape, or colour, or sound, affrights a horse; but when he finds that there is really no cause of fear, he is speedily reconciled. The horse is curious, and somewhat of an observer; moreover, he is formed by nature and inclination to see and constantly look behind him. This is indicated by the use of his heels, and by the necessity, in a wild condition, of fleeing from his enemies, the wolves and panthers. Now put a horse into a vehicle that makes much noise behind him—jingling, ringing, shaking,—he naturally feels anxious to look behind to ascertain the cause. If you approach a blinkered horse so that he cannot see you coming, and give him a sudden pat on the side or shoulder, he will start and tremble; but go up to him in front, and slap him ever so, he sees that there is no cause of fear, and does not stir. Supposing by some accident, a horse is left with a portion of a shaft, or any other fragment, dragging behind him, off he gallops, and is, he thinks, pursued by the dreadful thing following him, which he cannot see. At Naples, the hackney coach and cabmen use no blinkers to their horses; and I have observed for years the great advantages of the omission. Although these horses are generally spirited stallions, and sometimes vicious, never such a thing as their being frightened and running away occurs. Moreover, the horse keeps always one eye at least at the hand of the driver, so that the mere lifting of the whip is enough to make him pull, without its actual application. More might be said upon this subject, but brevity forbids me.

The "bearing rein" is an excellent device for taking from the horse a portion of his power of traction, and keeping him in a constant state of torment while in harness. The act of drawing requires the freedom of the neck, which should be allowed extension, instead of the chin being forced up to the throat. The constant pain to the horse's mouth, and the cramped muscles of the head and neck, are too evident to need discussion. We see the horses shaking, and shaking up their heads, and coachee gives them a good cut of the whip to ease them, I suppose, by substituting one sort of pain for another. Of course I shall be told of "the look of the thing," without "blinkers" or "bearing reins." Very well, then, go on using them. I have done my duty towards the steeds, by giving my opinion, which, I hope, others better qualified will enlarge upon.

PLANTS RECOMMENDED TO MORE GENERAL CULTIVATION.

Rhubarb.—Of the *rheum*, or rhubarb, there are several varieties, two of which especially deserve attention. They are known among cultivators as the *early scarlet*, and the *Goliath* or *giant rhubarb*. The former is valuable, as it may be gathered from three to six weeks earlier than any other sort, but the produce is small compared with that of the giant rhubarb, which, in the heart of a populous and smoky city, (where even the hardest shrubs cannot exist) produces stalks averaging more than 1lb. each. Rhubarb is of the same nature as the dock, (*rumex*) and will grow in almost any situation, if it has a rich and deep soil, and is kept free from other vegetation. The best way to cultivate this plant is to procure half an ounce of seed, which is very easily obtained; sow this in the months of March, April, or May, in a bed 10 feet by 4 feet, about three-quarters of a foot in depth; transplant in about ten weeks in a maiden, or else a well-manured soil, of at least 3 feet in depth, the giant 4 to 5 feet apart, the early 2 feet, and in the following year a considerable crop of full-sized stalks may be taken.

Sea Kale Beet, or *Silver Beet.*—This plant is totally different from the white beet, and is of recent introduction. It is entitled, by its wholesomeness and delicacy, as well as by its amazing produce and facility of cultivation, to a portion of every domestic garden. Unlike the mangel-wurzel, or red beet, which are of the same family, this plant has its produce *above ground*, the root being small and unimportant. The whole of the leaf is used. The leaf stalk, which is of an ivory whiteness, is separated from the green part, and boiled as sea kale, for which it is an excellent substitute, and whence its name; the remaining part of the leaf, when boiled, can hardly be distinguished from the finest spinach: and having the same virtues in a high degree, has been recommended by medical men as purifying and wholesome. It has besides this advantage, that one sowing, whatever the season, will yield an abundant supply for at least six months. The great difficulty in the growth of summer spinach is to prevent its running up to seed. This plant being biennial, does not flower till the second year, by which much useless labour and expense, incident to the growth of common spinach, are prevented. Early in April procure one ounce of seed for a bed of the richest soil, 30 feet by 6 feet, make holes 1½ in depth, and 1 foot apart in quincunx

order; (planted in a square, one at each corner, and one in the middle) into each put three or four seeds, and, if more than one come up, withdraw all except the finest plant. About the first week in June the leaves will be from 2 to 3 feet in length, and may be broken off close to the root for use.

The White Carrot.—This root, which is a new variety of the common garden carrot, *Daucus sativus*, is not yet much known. In colour it is something whiter than the parsnip: in flavour much more delicate than the orange carrot. The seed may be obtained in London, and it will, no doubt, soon be in general cultivation.

Indian Corn.—The large white variety sow in a hot-bed in April, transplant into a rich soil, and water freely. As soon as the feathery substance, or filaments, are developed, cut the ears, (stripping them of the numerous sheaths) which, when boiled, are palatable and nutritious.—*Noble's Compend.*

HORTICULTURAL HINTS.

Improved Method of treating the Scarlet Runner. As soon as the leaves show the signs of frost, carefully take up the roots, let them dry for a day or two in the sun, then bury them in dry sand, and keep them in a cellar through the winter; plant them again early in May, and they will produce a more abundant crop, with less vine, than seedlings; they may be so treated year after year, as this plant is perennial, but, like the nastardium and some others, destroyed by the severity of our winters.

The Cottager's Hot-bed Light.—Make a slight frame of two or three inches in width, to the size of the box, and tie across it strings dividing it into squares of about fifteen inches; paste together sheets of cartridge paper or newspaper sufficient to cover the whole, then paste and afterwards tack this to the outside of the light frame, letting it rest upon the strings. When perfectly dry, take a brush or sponge, and saturate the paper with linseed oil, which, when dry, will afford a congenial light to cucumbers, or even melons; retain the heat of the bed, draw the sun, and yet throw off the rays, and resist the weather for at least one season. Melons grown under such a light have carried the first prize for flavour and precocity at horticultural shows. Its economy is obvious.

Sparrows do more good than harm in a fruit garden, and the shots intended for their destruction much more harm than good, as any man of observation may see in the mutilated bark of the fruit trees on the one hand, and the insectivorous propensities of the sparrow on the other.

Fuchsia.——The different varieties of fuchsia are proved to be quite hardy. If planted in the borders they attain to a greater size than when kept confined in pots; and should the winter kill them to the ground, they will, in the summer, produce vigorous stems from the root.

Transplanting Trees.—In removing a tree, remember that every fibre is of importance, but especially the tap root, that is the perpendicular or main root; in proportion as this is injured, the tree will suffer. A seed set in favourable circumstances would in a very few years overtake a transplanted tree of ten or fifteen years' growth whose top root was damaged. Trees, when damaged, are often deprived of this great channel of nourishment, in order to make them produce a fibrous root. This end may be gained, but the loss of the tap root can never be repaired, consequently the tree will not attain its natural size and beauty. The most expeditious, economical, and productive method of forming a forest, would be to sow the seeds where they may remain to maturity.

Hoes.—The most useful kind of hoe for a garden is the Dutch hoe, made in the form of the letter D, in using which the operator is continually retreating before his work, instead of following and replanting the weeds by treading them in. We wonder it is not in more general use.

CURIOUS ANCIENT RECEIPTS.

To make China ink, or a curious black.—Take an ounce of lampblack, half an ounce of peach black, and one drachm of burnt endive, with a moiety of fig-leaf water, and another part of new milk, then add a little gum arabic, and being well beaten, for the mass into tablets for use.

To make a lasting walnut grain on any white wood.—The wood being very smooth, spread upon it seven or eight lays of strong glue till it become shining, then quickly give a good many blows with a wooden brush well wet in fair water, and the work will be perfected to admiration.

To counterfeit red coral.—Take the smoothest part of the horn of an ox; rasp it fine, then make a strong lye of wood ashes, and put the horn into it for five days, then take it out, add to it some vermilion dissolved in water; so put it over the fire to jelly and thicken, and form your figures with it in moulds, in such

shapes as you please, and when they are put into cold water they will harden, and look like natural coral.

To make any coloured hair black.—Take warm oil of tartar, dip a sponge in it, and rub over the teeth of the comb with it, and comb your head in the sun or by the fire; then, being dry, wash your head over with hyssop water, which will take away the scent of the oil, and in six or seven days so doing, the hair will be curious black.

To make crayfish red.—Rub them over with warm aqua-vitæ, and they will immediately turn red, though alive; and for a pretty trick, place some of the live ones in a dish among the boiled ones, and when the guests go to handle them at the table, and taking up a sprawling live one, they will start and wonder at it as much, as the story goes, as when Dr. Faustus by enchantment made a boiled calf's head bleat at the table, as the students were cutting it up.

To make a glue to hold against fire or water.—Mix a handful of quick lime in four ounces of linseed oil, boil them to a good thickness, then spread it on tin plates in the shade, and it will become exceeding hard, but it may be easily dissolved over a fire as glue, and will effect the business to admiration.

To make ink to rub out at pleasure.—Burn flax so that it may be rather mouldered than burned to ashes, then grind it with a muller on a stone, putting a little aqua-vitæ to it, then mix it with a little weak gum water, and what you write, though it seem fair, may be rubbed or washed out.

To make worms immediately come out of the ground.—Boil an ounce of verjuice in a quart of vinegar, and sprinkle a little on the ground where you suppose their beds are, and it will so disturb them, that they will immediately appear on the surface.

To hold fire in one's hand without burning.—Rub your hands with a good mixture of oil of vitriol, juice of plantain, and strong vinegar, and you may lay a piece of lighted charcoal in the palm of your hand, without feeling any sensible heat.

To make a candle that no wind will put out—Run a small wick dipt in brimstone and saltpetre through a small reed, then cover the reed with wax, or tallow, and as fast as it blows out, it will, by the virtue of the brimstone and saltpetre, light again of itself, to admiration.

To make ink that will vanish in twenty-four hours.—Boil nut galls bruised, in aqua-vitæ, and put some Roman vitriol and sal armoniac to it, and when cold dissolve a little gum arabic, and it will effect your desire. This is an excellent ink for lovers that would not have their letters seen when dropt, or carlessly mislaid; but I would not have it practised in knavish matters, to cheat those that are honest.

THE CHEMIST.

ACIDS.

NO. IV.

Citric Acid is obtained by the following process from lemon or lime juice. Boil the expressed juice for a few minutes, and when cold strain it through fine linen, then add powdered chalk as long as it produces effervescence; heat the mixture, and strain as before, a quantity of citrate of lime remains on the strainer, which, having been washed with cold water, is to be put into a mixture of sulphuric acid with 20 parts of water: the proportion of acid may be about equal to that of the chalk employed. In the course of twenty-four hours, the citrate of lime will have suffered decomposition, and sulphate of lime is formed, which is separated by filtration. The filtered liquor, by careful evaporation, furnishes chrystallized citric acid. The average proportion of citric acid afforded by a gallon of good lemon juice, is about eight ounces. Citric acid forms beautiful chrystals, of which the primary form is a right rhombic prism. They have a very sour taste, and are soluble in somewhat less than their own weight of water at 60°. It forms a class of salts called *citrates*.

Fluo-silicic Acid.—To obtain this compound, three-parts of fluor spar and two of glass or silica, finely powdered, are mixed in a retort, with about an equal weight of sulphuric acid. The gas evolved is to be collected over mercury, and when its production slackens, it may be accelerated by gentle heat. The mercury and glass vessels employed must be perfectly dry. Fluo-silicic acid, or silicated fluoric acid, as it is sometimes called, is a colourless gas; its odour is acid, much resembling hydrocilloric acid; its taste very sour. Its specific gravity 3.61 compared with air 100 cubic inches, weigh 110.138 grains. It extinguishes the flare of a taper; it produces white fumes when in contact with damp air, and when exposed to water is absorbed, and a soluble compound of silica and fluoric acid is formed, whilst a quantity of silica is at the same time precipitated. If the beak of the retort from which the gas is issuing, be plunged into a basin of water, it is soon

choaked by the copious deposit of hydrated silica which sometimes forms tubes through the water, by which the gas escapes directly into the air. When it is intended to saturate water with the gas, the effect above stated may be prevented, by agitation, or better by suffering the gas to escape through a stratum of mercury into water above it. Water thus saturated becomes a gelatenous mass, from which the acid liquor may be separated by placing it without pressure upon a linen filter. The liquor is sour, and when saturated with the fixed alkalies, becomes gelatenous but not turbid; with barylic salts it deposits a white precipitate; with bares it forms salts termed *Fluo silicates*.

Fluo boric Acid may be procured in a gaseous state, by heating it in a glass retort over a lamp, a mixture of one part of vitrified boracid acid, two parts of finely-powdered fluor spar, and twelve parts of sulphuric acid. It is most probable that in obtaining this gas, the oxygen of the boracic acid combines with the calcium of the fluor spar to form oxide of calcium or lime; and that the boron and fluorine unite to produce the gas. Fluoboric gas, according to Dr. Thompson, has a specific gravity 2.362, it is colourless, of a pungent odour, highly deleterious to respiration, and extinguishes flame. It strongly reddens litmus, and when bubbles of it are allowed to escape into the air, they produce a remarkable dense and white fume, in consequence of their eager attraction for and combination with aerial moisture. Water takes up 700 times its volume of the gas, increasing in volume and elasticity, forming a caustic and fuming solution, in which Berzelius found boracic and hydro-fluoric acids in combination; it would seem, therefore, that fluoboric gas decomposes water, and that the hydrogen of the water unites to the fluoric to form hydrofluoric acid, and the oxygen to the boron, to form boracic acid; when the solution is concentrated, the hydrofluoric and boracic acids again decompose each other, and the original compound is reproduced.

Formic Acid.—The peculiarities of an acid obtained by the distillation of *ants*, was first noticed by Fischer and Margraaf, but it was afterwards regarded as identical with acetic acid; Berzelius has shown, however, that it is a distinct compound; and Dobereiner has published some curious facts respecting its artificial formation. It may be obtained from a mixture of two parts of chrystallized tartaric acid, five of peroxide of manganese, five of sulphuric acid, and five of water. Soon after mixture, these ingredients, which should be in a sufficiently capacious vessel, effervesce violently, and give off abundance of carbonic acid, if afterwards distilled; the formic acid passes over: it possesses several peculiarities which amply distinguish it from acetic acid, among which the most remarkable is in the action of sulphuric acid, which converts it into water and carbonic oxide. The formic acid is converted into carbonic acid by the nitrates of silver and of mercury, those salts being at the same time converted to the metallic state. Its compounds are called formiates.

Gallic Acid may be obtained by the following process:—Digest bruised galls in boiling water, with about one-sixth their weight of vellum cuttings, for some hours, then allow the mixture to cool and filter it. Add to the filtered liquor a solution of acetate of lead as long as it occasions any precipitate from the whole upon a filter; wash the precipitate with warm water, and digest it in very dilute sulphuric acid; filter, and having saturated the clear liquor with chalk, evaporate it to dryness. Introduce the dry mass into a retort placed in a sand bath, and upon the application of heat, a portion of water will first rise, and afterwards a chrystalline sublimate of gallic acid, or boil an ounce of powdered galls in sixteen ounces of water down to eight, and strain. Dissolve two ounces of alum in water, precipitate the alumina by carbonate of potash, and after edalcorating it stir it into the decoction. The next day filter the mixture, wash the precipitate with warm water till it will no longer blacken sulphate of iron, mix the washing with the filtered liquor, evaporate, and the gallic acid will be obtained in circular chrystals. Gallic acid, when pure, is in whitish chrystals. They have a sour taste, and evolve a peculiar smell when heated. It dissolves in about twelve parts of water at 60 deg., and in rather more than two parts at 212 deg. It is soluble in alcohol and ether. It forms no precipitates in solutions of potash or soda, but when dropped into lime water, baryta water, or stentia water, it occasions the separation of a difficultly soluble gallate of those earths. With salts of iron, gallic acid produces a more or less intense violet-coloured discolouration, and ultimately a reddish brown precipitate. It forms salts called *gallates*.

Hydriodic Acid Gas may be obtained very pure by the following process:—Hydroplosphorous acid is to be evaporated until upon the point of evolving phosphuretted hydrogen gas. It is then

to be put with its weight of iodine into a small tube retort, the gas is liberated upon applying a gentle heat; 100 grains of acid and 100 of iodine afford 120 cubical inches. It is colourless, very sour, exhales fumes in the air, and smells like muriatic acid. It reddens vegetable blues. Its specific gravity to hydrogen is as 63 to 1. It is not permanent at a red heat, for when passed through a red-hot Porcelain tube it is partially resolved into iodine and hydrogen. It is rapidly and abundantly absorbed by water, but in what exact proportion has not been determined. The specific gravity of the strongest liquid acid is 1. to 7. It becomes dark coloured when kept in contact with the air, in consequence of a partial decomposition. It readily dissolves iodine. It is decomposed by the nitric and sulphuric acids. The liquid hydriodic acid is best prepared by passing sulphuriated hydrogen through a mixture of iodine and water; sulphur is deposited, and on heating and filtering the liquor a pure solution of hydriodic acid is obtained, which may be concentrated by evaporation at a temperature below 260 deg. Its compounds are termed *hydriodates*. J. MITCHELL.

CHEMICAL NOMENCLATURE EXPLAINED.

EVERY science has its peculiar technical or conventional terms; and it is not only desirable and advantageous, but absolutely necessary that their meanings should be properly and clearly defined and understood, if we wish to become thoroughly acquainted with the subject to which they relate. In our last number we gave an amusing extract from a little volume entitled "Chemistry no Mystery;" we now extract the following from the same source, with the hope that it will not only prove interesting to our readers, but a recommendation to a work which we strongly recommend to the chemical novice:—

"We have hitherto regarded simple bodies as combining together and forming compounds; but we have taken no account of the combinations which occur between compounds themselves: of these there are a very large number, and the nature of some of them is not at all easy for a beginner to understand. Their composition was formerly much more difficult to remember than at the present time, because chemical substances were named after no fixed rule, but only according to the whim and caprice of their discoverers.

"Amongst the successful labours of modern chemists, the method of naming substances in a manner to indicate their composition, stands high in the scale of practical utility. You may already have formed some idea of its importance, although I have not directed your attention exclusively to the matter. The term chlorine indicates that the gas is greenish; hydrogen means the water-former, and oxygen the acid-former, because chemists imagined that every acid contained it. This opinion is incorrect, since *every* acid does *not* contain it; yet the greater number do, and therefore the term oxygen may still be retained with considerable propriety.

It is always taken for granted that an acid contains oxygen, except the contrary be expressed. By the term sulphuric acid, I understand an acid composed of sulphur and *oxygen*; by *hydro*-sulphuric acid, an acid composed of sulphur and *hydrogen*. When oxygen only forms two acids with a substance, then the name of the acid which contains the *smaller* proportion of oxygen is made to end in *ous*: and of the one which contains the *larger* proportion of oxygen in *ic*. If there should exist more than *two* combinations, then we are obliged to have recourse to *Greek* and *Latin words*. I may illustrate what I mean by referring to the compounds of sulphur and oxygen. Formerly only two such compounds were known; one composed of one atom sulphur and two atoms oxygen, and the other of one atom sulphur and three atoms oxygen; the former was called sulphur*ous*, and the latter sulphur*ic* acid. More recently there have been discovered two other compounds of oxygen and sulphur; one of which contains less oxygen than sulphur*ous* acid, and the other more oxygen than sulphurous, but less than sulphur*ic* acid; hence they are respectively called *hypo*-sulphur*ous* and *hypo*-sulphur*ic* acids; hypo, or upo, meaning under or less. In this diagram the two original compounds of sulphur and oxygen are represented by capitals; the two others by small Roman letters.

	Sulphur.	Oxygen.
Hypo-sulphurous acid	2	2
SULPHUROUS ACID ..	1	2
Hypo-sulphuric acid.....	2	5
SULPHURIC ACID	1	3

Now, before the introduction of this new nomenclature, sulphuric acid was known by the name of oil of vitriol; a name which gives us no useful information whatsoever, indeed it misleads us, for the so-called oil of vitriol is *no oil at all*.

If an acid whose name ends in *ic* com-

bine with a substance, the name of the compound is made to terminate in *ate*; for instance, sulphuric acid with soda forms sulph*ate* of soda. If an acid whose name terminates in *ous* combine with a substance, then the name of the resulting compound is made to terminate in *ite*; for example, sulphur*ous* acid with soda forms sulph*ite* of soda. When a simple substance unites with oxygen, and does not form an acid, the compound is simply termed an oxide. In like manner the combination of iodine, chlorine, bromine, sulphur, and fluorine, with other simple substances, forms chlorides or chlorurets, iodides or iodurets, bromides or bromurets, sulphides or sulphurets, and fluorides or fluorurets. But the advantages of the new system of nomenclature are best displayed by some other examples which I now mean to give you.

"The chemist, Glauber, discovered a salt, which was long known by no other appellation than *Glauber's salt*; but this name conveys very little useful information indeed;—merely giving us to understand that Glauber was, in some manner or another, connected with it; a matter of very slight importance. Now Glauber's salt being a compound of sulphuric acid with soda, the framers of the new nomenclature called it sulph*ate* of soda, a term which immediately bespeaks its composition, and affords us a very useful piece of information. Again, there exists a substance commonly known by the name of sal-ammoniac; but what information does this convey? None at all: whereas the term hydrochlorate of ammonia, informs us that it is a compound of hydrochloric acid and ammonia."

ATMOSPHERIC GASES.

By experiments carefully conducted, it has been found, that the composition of the atmosphere is extremely uniform in all parts of the earth, and at all heights above its surface, and that it consists of

	By measure.	By weight.
Oxygen	21	23
Nitrogen	79	77
	100	100

Though these are the essential constituents of atmospheric air, it contains other bodies which are regarded as adventitious, and the quantity of which generally varies; of these, carbonic acid and aqueous vapour are the most important; the quantity of the former may be considered as amounting to about .01 per cent., so that upon the whole, the constituents of the atmosphere may be regarded as follows:—

	By measure.	By weight.
Nitrogen	77.5	77.55
Oxygen	21.	21.32
Aqueous vapour	1.42	1.03
Carbonic acid	0.08	0.10
	100	100

Nitrogen is a colourless gas, with neither taste nor smell, having no action upon vegetable colours nor lime-water; neither is it absorbed by water, unless that fluid has been deprived of its ordinary portion of air by boiling, when it takes up about one-and-a-half per cent. It is rather lighter than atmospheric air, compared with which, its specific gravity is 0.972. Its specific gravity, in reference to hydrogen, is as 14 to 1. An animal immersed in nitrogen is instantly suffocated, whence it was called by Lavoiser *azote* (from *a privative* and *ζωη, life*); but if that term be taken in its strictest sense, all gaseous bodies (excepting atmospheric air), might be included under it, for even oxygen itself will not indefinitely support life. The term nitrogen merely implying that it is a component of nitric acid; it is explicit and unobjectionable, therefore it is adopted in preference to azote. Nitrogen is a non-supporter of combustion. It may be obtained by mixing equal weights of sulphur and iron filings into a paste with water, and expose them to a confined portion of atmospheric air for forty-eight hours; the oxygen will be absorbed, and the nitrogen left nearly pure.

Oxygen may be obtained by mixing powdered oxide of manganese and sulphuric acid in such proportions, as to be about the consistence of cream. This mixture is to be put in a glass retort, and heated over an Argand lamp; the gas will pass over, and may be collected in the usual way with the pneumatic trough. It is insipid, colourless, and inodorous. Its specific gravity, compared with air, is as 1.111 to 1.000; compared with hydrogen, as 16 to 1. When powerfully compressed by the powerful depression of a piston in a glass tube, it becomes enormously luminous, a property which has not been observed in any gaseous body, except such as contain oxygen, and which property may be considered as one of its characteristics. It is absorbed in very small quantity only by lime-water. It does not alter the colour of litmus, nor does it render lime-water turbid. It is a powerful supporter of respiration. A small animal confined in oxygen, lives thrice as long as when con-

fined in the same quantity of common air; it has, therefore, been called *vital air*; but, as I before stated, it will not sustain life for any long period. A lighted taper when introduced into this gas, is very rapidly consumed, with intense ignition and enlargement of the flame. Sulphur, which burns in the air with a small blue flame, soon has its flame enlarged when immersed in a jar of oxygen, and burns with a beautiful colour. When phosphorus is burnt in oxygen, the light is so intense, that the eye can scarcely bear its brilliancy. Oxygen is more abundantly diffused throughout nature than any of the other elementary bodies. An account of carbonic acid will appear in one of my next papers on acids.

J. Mitchell.

MISCELLANEA.

The Sting of Bees.—Although the poison which a bee emits, when it inserts its sting, is proved to be a highly concentrated acid, it does not follow that the application of all alkalics will neutralize the acid. Ammonia, for example, we have known in several instances, to produce distressing consequences—such as excessive local inflammation, temporary erysipelas, and general distress to the constitution. The more gentle alkalies—chalk or the "blue bag," are much more likely to effect a cure, and cannot injure. The same person will be variously affected by the sting of a bee; at one time scarcely any inconvenience will attend it; at another much swelling: again, but little enlargement, although great pain, &c. The eye suffers considerably, though in general the uneasiness is local; but if the back of the ear be stung, there is frequently a general affection of the system, sickness, giddiness, numbness, nervous trembling, &c., which will sometimes continue for hours. A draught of camphor julep, and total repose, we have known to be beneficial in this latter case, and would earnestly recommend it to our readers, should they be placed in circumstances to require assistance.

Drawing an Inference.—The proprietor of an immense number of water-side carts in Liverpool, who has raised himself by industry to be a man of considerable property, being in close conversation with a gentleman about some private business, was asked by the gentleman if he could draw an inference. "Not I," said he, "but I bought a mare the other day, and I'll lay a five-pound note that she draws it, if it does not weigh more than five tons."—*Noble's Compendium.*

Loch Leven.—The origin of the name Loch Leven is somewhat curious. It arises from the circumstance of the number eleven frequently occurring in matters connected with the lake. As already mentioned, it is eleven miles in circumference; the lands of eleven lairds at one time embraced its waters; there are eleven rivers and streams running into it; it contains eleven kinds of fish; and in the adjoining plantations are eleven kinds of wood. The name was, therefore, originally, Loch Eleven; but in the course of time the E was omitted as at present.—*Walks and Wanderings in the World of Literature, by the Author of "The Great Metropolis."*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 23, Rev. R. Vaughan, D.D., on the History and Antiquities of Athens. Friday, Oct. 25, S. C. Horry, Esq,, Barrister, on Petit Juries, their Origin, Rights, Duties, and Influence. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 24, John Frederick Goddard, Esq., Lecturer on Optics at the Royal Gallery of Practical Science, on the Oxyhydrogen Microscope, with illustrations. At half-past eight.

QUERIES.

What will be the thickness of metal required for a concave copper ball, eight inches diameter without, so as to sink to its centre in common water? A. D. M.

How to procure India-rubber thread, such as is used for braces, lapped with cotton twist.

A Constant Reader.

Blackburn.

How to make crumpets, muffins, gingerbread, biscuits, and buns? A. A.

The preparation to be applied to a stucco wall before papering, and likewise the ingredients used in making paper-hangers paste?

A Subscriber.

How is steel to be gilt in the cheapest way, as steel pens? What kind of varnish is used for Dutch metal on paper or on wood, for preventing tarnishing? Is it oil or spirits of wine?

A Constant Reader.

The power, weight, and dimensions of Hancock's steam gig or phæton? J. Mitchell.

If J. Mitchell can inform me how to obtain a *pre*sulphate of iron, he will much oblige a

Juvenile Entertainer.

ANSWERS TO QUERIES.

To make Green Fire.—Seventy-seven parts of nitrate of baryta, thirteen parts of flowers of sulphur, five of chlorate of potassia, and a small quantity of charcoal.

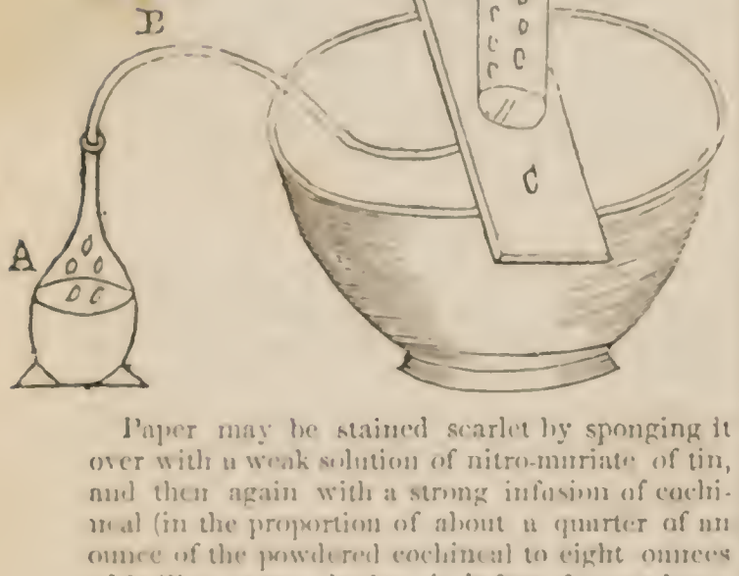
To make Carbonic Acid Gas.—"A Subscriber," will find the process described in one of my papers on the acids in Nos. 1 & 2 of the fifth volume. J. Mitchell.

To make Frankfort Black.—"F. J. F." This is made by calcining vine branches and other refuse lees of the vinegar vats of Germany; they must be previously washed.

Juvenile Entertainer.

To procure Hydrogen.—Pour diluted sulphuric acid, or spirits of vitriol, as it is generally called, upon iron or zinc filings, or turning in a Florence flask, adapted with a good cork, and a piece of bent tubing. It can then be collected with the pneumatic trough. I have used a very good and cheap substitute for the pneumatic trough, which will perhaps be useful to some of your readers:—A, the flask, containing the diluted acid and filings; B, the bent tube; C, the shelf; D, the receiving vessel, and E, the basin, answering the purpose of a pneumatic trough.

J. Mitchell.



Paper may be stained scarlet by sponging it over with a weak solution of nitro-muriate of tin, and then again with a strong infusion of cochineal (in the proportion of about a quarter of an ounce of the powdered cochineal to eight ounces of boiling water, letting it infuse for one hour, then strain it). The paper is then glazed, by submitting it to a powerful pressure.

To make Fluoric Acid.—"Jones." Fluoric acid is procured from a substance well known in mining districts called fluor spar. It is found chrystallized in cubes of various colours, green, yellow, and purple. If this mineral be reduced to powder, mixed with twice its weight of strong sulphuric acid (oil of vitriol), and subjected to distillation, a powerful and highly corrosive liquid may be obtained. For this purpose, a leaden or silver retort and receiver must be employed; and while a moderate heat is applied to the retort, the receiver must be kept cool by pounded ice or snow. The acid thus formed must be preserved in silver or leaden bottles, with stoppers of the same materials. It is extremely volatile, and not easily confined. It is necessary to use great caution when experimenting with this substance, as its vapours are highly irritating, and when applied to the skin, it disorganizes it so rapidly, as to occasion dangerous ulcers. It acts strongly on glass, and corrodes it deeply.

To make an Infusion of Gentian.—"F. J. F." Take of gentian root bruised, two drachms; dried orange peel, two drachms; and fresh lemon peel, four drachms; pour upon these ingredients one pint of boiling water; let them infuse for one hour. The above is the same as ordered in the London Pharmacopœia.

To make Red Fire.—"G. R. C." Forty parts of dry nitrate of strontia, thirteen of powdered sulphur, five of chlorate of potassa, four of sulphuret of antimony, and a very small quantity of charcoal. The chlorate and sulphuret should be separately powdered and mixed together on paper with the other ingredients.

Plaster Figures may be Varnished after being done over two or three times with size, so that they will bear washing.

To Polish Shells.—This may be done either by hand labour, or by being varnished; in both cases all the rough parts must be well rubbed down with emery and water. If they are to be polished by hand (which is the best and most lasting way), after they have received two and three courses of emery of different degrees of fineness, they must be finished with buff leather dressed with rotten-stone and oil.

TO CORRESPONDENTS.

Juvenile Entertainer.—*His apparatus for remaining under water, a drawing and description of which we have received, we consider as not only ingenious, but likely to become of great utility, especially in the cases he mentions; if it be his intention to divulge his invention, we shall feel pleasure in recording it in the "Mechanic;" but some expressions in his letter have caused a doubt whether he intended it as a private communication, or for insertion—we await his answer.*

A. B., *the Inventor of an apparatus for stopping horses, is requested to send us his address, a gentleman having written to us expressing a wish to see the invention.*

S. Rowbotham, *Worcester, will receive a communication per post.*

Tyro Chemicus *will find a letter addressed to him at our office. Letters are also left for our correspondents*—Electron, J. Mitchell, Alpha, and C. H.

Numerous queries and other communications, for which we have not sufficient space this week, are nevertheless intended for insertion.

A SPLENDID RAILWAY MAP!

With the Mechanic and Chemist of October 26th, will be presented (gratis) a

SPLENDID MAP OF ENGLAND AND WALES; shewing, in addition to all the Principal Towns, the routes of the Railways through the various Counties; forming a handsome Frontispiece to Vol. IV. To ensure early impressions, give immediate orders to your Booksellers or Newsmen.

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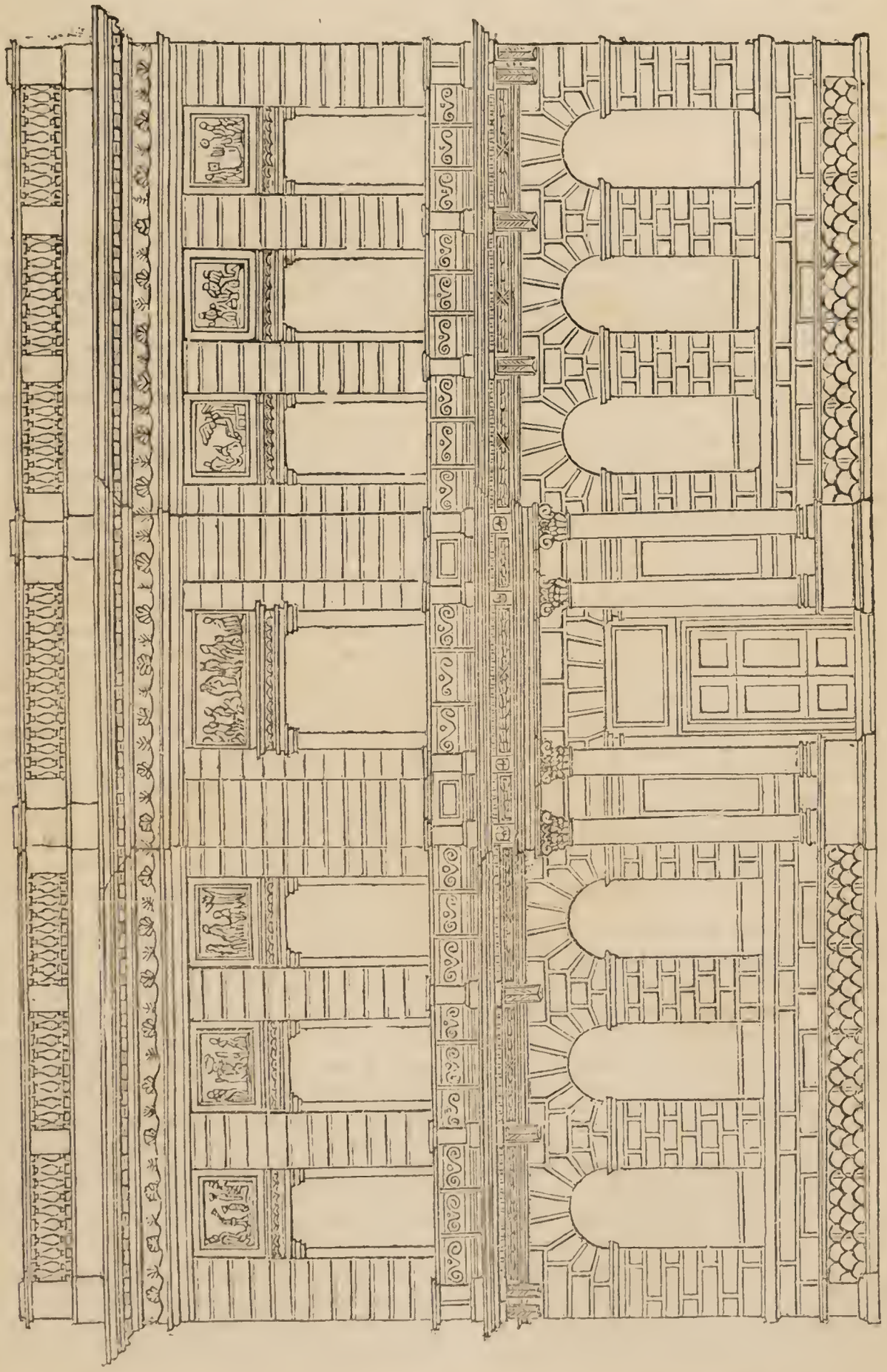
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 57 & 58, NEW SERIES. } SATURDAY, OCT. 26, 1839. PRICE TWO-PENCE. { Nos. 178 & 179, OLD SERIES.



FRONT ELEVATION OF THE OXFORD AND CAMBRIDGE UNIVERSITY CLUB HOUSE.

VOL. V.—Nos. 8 & 9.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney

HISTORY OF ARCHITECTURE.

NO. VIII.

(Concluded from page 362.)

(See engraving, front page.)

We have now briefly glanced at the progress of architecture in England up to the time of Sir Christopher Wren, many of whose works are extant. As a finale, we will give an example of the architecture of the present day by *living* architects. The one selected for this purpose is the *Oxford and Cambridge University Club House*, for the elevation of which, and the following particulars, the writer is indebted to the "Civil Engineers' and Architects' Journal."

"The front extends 87 feet in width, its height being 57 feet from the ground line to the top. An entablature, marking the separation of the ground story from the principal floor, and projecting forward in the centre of the building over four Corinthian columns, divides the front, horizontally, into two equal parts. The centre space on the ground floor is occupied by the portico which projects to the front line of the area; the centre intercolumnation is wider than the rest, forming the entrance to the hall; the four columns stand upon pedestals four feet high, with mouldings and cornice. The upper part of the building is terminated with a delicate Corinthian entablature and balustrade, proportioned to the whole height, breaking forward with the centre of the building, which corresponds in width with the portico on the ground-floor; thus the front is divided vertically into three main compartments, the centre being less in width than the other two, which assume the appearance of wings; the effect of a centre, indicated by the projecting portico on the ground-floor being thus maintained throughout the whole height of the building.

"The angles of the centre division, on the principal story, are formed of rusticated pilasters; the principal window occupies the space between these pilasters, which having neither bases nor capitals, produce a uniformity in the lines round the windows, giving it the appearance of being contained in a frame. This window, designed with *antæ*, in lieu of architecture, supporting an enriched entablature, is much wider than the rest, and standing clear of the pilasters, with its mouldings to profile, forms in itself a feature in the design. Rusticated pilasters, similar to those already described, divide each wing on the principal floor into three equal, recessed, oblong spaces, containing the windows, similar in design to the one already described, except that the mouldings to the *antæ* and entablature do not profile, but stop against the inner side of the pilasters. The ground story is rusticated, and the windows have semicircular heads, with radiating rustics, and impost mouldings. A balcony, projecting three feet, continues throughout the whole line of front, and breaks forward with the portico, the parapet being formed of pedestals, with intervening panels of richly-designed foliage, cast in metal in high relief, and the landing supported by elaborately enriched consoles. The frieze of the entablature over the ground story, is filled with convex panels, enriched with laurel leaves, and over each column of the portico are shields bearing the arms of the Universities. The whole of the ornamental detail throughout is designed to correspond in richness of effect with the Corinthian capitals of the columns, which have their central volutes entwined. Below the ground story there are two stories, a *mezzanine* and basement, which are screened by the area parapet.

"The bas-reliefs in the panels above the windows of the principal floor require particular notice; they are executed in Roman cement by Mr. W. G. Nicholl, from designs by R. Smirke, Esq., R. A., and illustrate those exalted labours of the mind which it is the peculiar province of the Universities to foster and promote. They recall to mind the sovereignty of Greece and Italy in the divine art of poetry, and the full measure of intellectuality vouchsafed to the inhabitants of this our portion of the globe. In the centre panel Minerva and Apollo preside on Mount Parnassus, a female figure personifying the river Helicon, forms part of the group, and pours from an urn the source sacred to the God of verse; the Muses surround them at the foot of the Mount. In one of the extreme panels, allusion is made to the popularity of the Iliad, in which Homer is represented singing to a warrior, a female, and a youth; in the other, Virgil is represented singing his Georgics to a group of peasants. The remaining four panels represent, first, Milton reciting his verses to his daughter, inspired by a superior agency seen hovering over him; Shakespeare attended by Tragedy and Comedy; Newton explaining his system; and Bacon recommending his philosophy to his auditors."

This building is situated on the south side of Pall-mall, near St. James's Palace, and Sir Robert Smirke, R. A., F. R. S., and Sydney Smirke, Esq., are the architects.

In this series of papers, of which the present is the last, the primary condition, viz., that of viewing the "History of Architecture" in *religious* edifices, has been in general adhered to; though, in some instances, it was necessary to deviate from the course suggested. We first attempted to consider the massive, but grand and imposing Egyptian style; next, the elegant and ornate Greek; then the bold Roman, and, lastly, we have less briefly reviewed the progress of architecture in England. In conclusion, permit us to hope that these articles have been found interesting and instructive, if so, the object of the writer is attained.

PROPORTIO.

TRANSFERRING PRINTS TO THE SURFACE OF WOOD, AND EITHER REVERSING THEM OR NOT;

AND ON MAKING AND APPLYING HARD WHITE SPIRIT VARNISH.

(From Journ. de la Societe du Bas. Rhin.)

THIS poocess is very analagous to that formerly employed in transferring prints to the surface of glass, and to the back of which prints coloured were afterwards applied, so as in some degree to imitate oil pictures. Here, however, they are applied upon the surface of wood, such as cornel, sycamore, horse chesnut, satin wood, *aer wood*, or the curly-veined maple, &c., which is afterwards to be varnished.

The wood having been planed smooth and even, is to have a slight coat of the best glue applied upon it; when this has become dry, it must be rubbed with Dutch rushes, or glass paper, to remove the small filaments which the glue has raised, and render the surface uniform. We then apply a layer of white alcoholic varnish, taking care not to cross the marks left by the brush, and pass as few times as possible over the same place; it is then left to dry. We afterwards apply in succession, three, four, five, or six, other coats of varnish upon it, according as the varnish may be thinner or thicker.

The edges of the print are then to be cut close to the engraving; and it must be laid upon a proper table with the impression downwards; it must be then uniformly moistened with a wet sponge, or in any other manner. When it has been equally and thoroughly wetted, it must be placed between two leaves of blotting paper, in order to remove any drops of water. We then apply another coat of varnish over the surface of the wood; and before it is become dry, apply the moistened print upon it with the engraving downwards. In order to do this, we lay one edge of the print first upon the surface of the wood, holding it suspended by the other hand, and wipe successively over the back of the print in such a manner as to drive out all the air and prevent the formation of blisters. We then lay a sheet of dry paper upon it, and pass a linen cloth over every part of the print, in order to fix it securely upon the varnish. We must take great care to place the print steadily upon the varnished wood, lest we may make a false or distorted impression of it. We then leave it to dry; and when it has become thoroughly dry, we moisten the back of the paper with a sponge, and pass or lightly rub the fingers backwards and forwards over it repeatedly, so as to remove the moistened paper in small rolls curled up. When, however, the marks of the picture begin to appear, we must take care, lest in rubbing we should remove any portion of the paper upon which the impression is taken. When we find, therefore, that we can remove no more of the paper without incurring the risk of injuring the print, we suffer it to dry; in drying, the engraving will entirely disappear at the back of the print, it remaining covered with a slight film of paper. But, on again giving one coat of varnish, it will be rendered entirely transparent. It must then be again suffered to become quite dry. If by chance we have raised any small parts of the engraving, we must retouch those defects with fine lamp-black and gum water, before we proceed to varnish, as we have before mentioned; great care must be used in laying on a second coat of varnish, passing rapidly over the retouched parts. When this last coat of varnish is become perfectly dry, we may remove any projecting part of the paper, and polish it with Dutch rushes, steeped for three or four days in olive oil; we then remove the oil by rubbing with a fine linen cloth, and sprinkle it all over with starch or hair powder; this will absorb the least remains of the oil, and we remove it by first passing the palm of the hand over it, and then by carefully wiping or rubbing it with a fine linen cloth; we next apply three or four more layers of varnish, taking care to let it dry between each coat. When the last coat is become quite dry (in three or four days' time), we polish the varnish with a piece of fine woollen cloth, and chalk or whiting of the finest kind.

In order to prepare this fine chalk, we must grind the ordinary chalk in a mortar with a little water; and when it is well

ground, we add more water, and pour it into a glass vessel, suffering it to remain at rest for five or six minutes, it will then have deposited its coarser particles. We then decant the liquid, which holds in suspension the finer particles of the chalk; let it rest, and when the water has become clear we pour it off, and shall find the sediment in the form of a paste, and which we use to polish the varnish with. We must take care to use it in the moist or wet state; as, if it becomes dry, it is impossible to preserve it in the minutely divided state, and we should run the risk of polishing the varnish in streaks. If, however, we would have the varnish still more shining, we must wash off all the remains of this fine chalk with water, and polish it with the palm of the hand only slightly moistened. But to have it still more brilliant, after having washed away all the chalk and suffered it to become quite dry, we must pass all over it a thin coat of varnish, either in the sunshine, or near a warm stove, in order that the varnish may be extended uniformly upon the surface.

White Spirit of Wine Varnish.

Rectified spirit of wine.....	24 oz.
Fine sanderach	4
Fine turpentine	1
Spirit or oil of turpentine.....	1
Camphor.....	2 gros.

We must select the most transparent sandarach, and that which is the least yellow; but if it be not of the best possible kind, we must wash it in a weak lie of potash, and then in a large quantity of water, and let it dry perfectly. For the quantity above directed, we must take a bottle of white glass well dried, and of the capacity of forty ounces; and after pulverizing the sandarach, we reduce the particles of it to a kind of thin paste, by triturating it with some of the spirit of wine, and put it by degrees into the bottle. We likewise mix the turpentine and the oil of turpentine together, by rubbing them up in the same mortar; and when the turpentine becomes more liquid, we may increase its liquidity by adding some spirit of wine to it, and pour it into the bottle, when we must shake it for some time, in order to mix the materials well together. We likewise put the camphor into the mortar, and beat it up with some drops of spirit of wine; we then add a larger quantity of the spirit, which will entirely dissolve it; this is then to be poured into the bottle, and it must be again well shaken for some time, in order thoroughly to mix all the materials together. The bottle must then either be exposed to the heat of the sun or that of a warm stove, for ten or twelve days, taking care to shake it from time to time, and to unstop it, in order to suffer the vapour to escape; but finally it must be close stopped, and the varnish kept for use.

On applying the Varnish to Wood.—We place the subjects which we would varnish, either in the sunshine or near a warm stove. We then apply six, eight, or ten coats of varnish. We must take care never to apply a second coat until the former one has become quite dry. If we could give the piece of work a fine lustre, we may polish the varnish after the last coat is become quite dry, with finely-washed chalk, applied whilst wet upon a soft woollen cloth; or we moisten the palm of the hand and rub the varnish with it, until it has acquired a perfect polish. Before applying the varnish upon wood, however, we must always prepare it by a coat of glue.

On fixing Prints upon Wood, in their natural position, and removing the Paper from them.—We select a surface of any kind of wood, the size of the print; we then moisten a piece of thick drawing paper, of a proper size, and apply upon its surface a layer of thin glue; we then suffer it to dry, and give it two or three more coats of the same glue, letting it dry between each coat; we then prepare the surface of this paper, to receive the print, in the same manner as the wood was prepared, as described in the first part of this article, by coating it with several layers of spirit varnish. We then apply the print, and conduct the operation exactly as before, to the period when we remove the last portions of oil by means of starch, and give several layers of varnish. The wood being then prepared to receive the print by the coat of glue, and several layers of varnish applied in the manner before described, we fix upon it the leaf of drawing paper, bearing the print upon its prepared surface. We then apply a coat of varnish to the wood, and affix the prepared paper, and print upon it whilst it is still moist; and so as to prevent the forming of any blisters of air bubbles between them. When we think that the varnish is become hard, with the help of warm water and a sponge, we moisten the glued paper which covers the whole; we then remove that paper, which readily comes off; and with the aid of warm water and the sponge we cause the glue to disappear from the varnished surface of the print; we then polish it with prepared chalk, and finish it, as before

stated. This process may also be employed, not only to apply prints upon the surface of wood, but also upon metals, &c.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 45.)

Stoney Stratford, a market town in Buckinghamshire, is situated on the Roman paved way called Watling-street, from which the name of Stoney was probably derived. It contains a church dedicated to St. Giles, and the ruins of another, which was nearly destroyed by fire in 1742. There are meeting-houses for dissenters of several denominations, numerous charity schools, and a society for apprenticing children. The centre of the town was formerly adorned with one of those beautiful crosses which were erected upon the spots where the remains of Queen Eleanor rested; but it was destroyed, with many other valuable monuments, by the barbarous zeal of the snuffling hypocrites of the revolution.

Fenny Stratford is also situated on the Watling-street; it is a small market town of little trade, surrounded by land which was formerly a fen, but now completely drained, and its waters carried off by the Grand Junction Canal. The chapel was rebuilt in 1724, by the exertions of Mr. Browne Willis, an antiquary, who dedicated it to St. Martin, and laid the first stone on St. Martin's day; the saint is indebted for this compliment to the circumstance of Mr. Willis's grandfather dying on St. Martin's day, in St. Martin's lane. The Swan Inn is said to have borne that name ever since the year 1474; another inn, now of little note, the Black Bull, was anciently the abode of a fraternity of monks. This dull town, like most others on the line, has suffered much loss by the traffic being transferred to the Railway.

Buckingham, the county town of Buckinghamshire, is a borough and market town, 55½ miles from London, and ten miles west of the Railway. It is a place of very great antiquity. It is supposed by some to derive its name from *Bec*, a beech, with which description of tree the county formerly abounded; others assert that it was adopted from the deer which were found in great nnmbers in the woods of this part of the country; others, finding that the name was originally written *Bockingham*, trace its derivation to the Saxon *Borking*, a chartered land, and *ham*, which in Saxon signifies a home. It has been the scene of some important historical events; it was here that the Roman general, Aulus Plautius surprised and defeated the Britons under the command of the great Caractacus, and a kinglet called Togodumnus. In 918, Edward the Elder resided here for some time, and erected two forts to defend it from the Danes, who nevertheless took the place and ravaged it in 941, and again in 1010. At the time of the Norman Conquest, it was the only borough in the county; and so inconsiderable a place, as only to be taxed for one hide. In the reign of Edward III. its importance was increased by that prince making it a market for wool; but that trade being afterwards removed to Calais, it again declined. In the 27th year of Henry VIII., it was enumerated amongst the decayed cities and towns, for whose relief an Act of Parliament was then passed, and the assizes, previously held here, were removed to Aylesbury, through the interest of John Baldwin. In 1724, Buckingham suffered severely from a dreadful fire, which entirely consumed 138 houses, being above one-third of the whole town. The damage was estimated at 40,000*l*. Since this accident, its trade has partially revived, and part of the county business has been restored through the influence of Lord Cobham. The church is the most conspicuous monument in Buckingham; it was commenced in 1777, and completed in four years, at an expense of 9,000*l*. of which 7,000l. was contributed by Earl Temple. It is a spacious and handsome structure, with an ornamented square tower, and an elegant spire, which rises to the height of 150 feet from the ground. The interior is constructed on the same plan as Portland Chapel in London. No interments are permitted in the church or in the ground adjacent to it, nor are funeral ceremonies allowed to be performed; but about two hundred yards south-west of the church, there is a burial ground, and a small chapel for the accommodation of the clergyman at funerals. The area surrounding the church is laid out in a pleasant walk, planted with trees. A view is obtained from this spot of the serpentine course of the river Ouse, which winds round three sides of the town. Buckingham contains some excellent charitable institutions, and various accommodation for divers religious sects. It has given the title of Duke to several families. The present Duke is said to have obtained the title through the intercession of Louis XVIII. with the Regent, afterwards George IV. Previous

to the departure of the French King from this country, the Marquis of Buckingham gave up his mansion, Hartwell House, near Aylesbury, for the occupation of the exiled King.

COLOURED FIRES.

A LITTLE work, entitled "the School Boy's Holiday Companion" was advertized a month or two back, on the covers of "the Mechanic;" it is not yet published, but will be ready in a few days. The author has allowed us to present our readers with the following extracts, which will answer the queries that have been addressed to us from several correspondents, and be particularly acceptable at the approaching season, which for ages past, has been devoted to the exhibition of fire-works.

The following will be found among its pages:

White Fire.—1 Lamp black, 2 red arsenic, 7 sulphur, 24 nitre.

Blue Fire.—1 Lamp black, 1 sulphuret of antimony, 2 sulphur, 6 nitre.

Green Fire.—1 Lamp black, 3 chlorate of potash, 8 sulphur, 42 nitrate of barytes.

Purple Fire.—1 Lamp black, 2 red arsenic, 7 sulphur, 21 nitre, 21 nitrate of strontian.

Crimson Fire.—2 Lamp black, 4 sulphuret of antimony, 5 chlorate of potash, 13 sulphur, 40 nitrate of strontian.

Several others are given, with directions for using them; but these may suffice for the present. A good way is to pour them into a red-hot ladle.

In the plate is a pneumatic trough, very similar to the one described by your able correspondent, Mr. Mitchell. The board, instead of lying on the basin, is cut smaller, so as to sink an inch into it, and is kept down by two pieces of lead fastened to the under side.

MISCELLANEA.

Steam Travelling on Common Roads.—We have the satisfaction of announcing to the public, that Mr. Hancock's steam carriage, the *Automaton*, accomplished its first trip from London to Cambridge on Monday last. The carriage left the Four Swans, Bishopsgate-street, at ten o'clock in the morning. The time in actually running the 52 miles was four hours and a half.—*Cambridge Free Press.*

Antiquity of Railways and Gas.—Railways were used in Northumberland in 1633, and Lord Keeper North mentions them in 1671 in his journey to that country. A Mr. Spedding, coal agent to Lord Lonsdale, at Whitehaven, in 1765, had the gas from his Lordship's coal-pits conveyed by pipes into his office for the purpose of lighting it; and proposed to the magistrates of Whitehaven to convey the gas by pipes through the streets to light the town, which they refused. —*Worcester Guardian.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 20, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 30, Rev. R. Vaughan, D.D., on the History and Antiquities of Athens. Friday, Nov. 1, S. C. Horry, Esq., Barrister, on Petit Juries, their Origin, Rights, Duties, and Influence. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 31, W. Maugham, Esq., A. Inst., C. E., Lecturer on Chemistry at the Royal Gallery of Practical Science, on Lime, Baryta, and Strontia, and their use in the Arts. At half-past eight.

TO CORRESPONDENTS.

J. Mitchell's *suggestion shall be taken into consideration.*

Juvenile Entertainer.—*His apparatus for enabling divers to remain under water without communication with the atmosphere above, will appear as soon as the engraving is ready.*

J. T. *will receive all the information we can obtain, next week.*

W. H.—*An article will shortly appear on the subject of his enquiry.*

J. W. *will also find his queries answered in the same article.*

A Correspondent *is informed that he may see a small steam boiler nine inches and a half long and five inches and a half in diameter, with feed-cock, safety-valve, pipe, and stop-cock, at No. 3, Norman-buildings, Haggerstone Bridge Kingsland-road.*

D. J.—*A periodical work devoted exclusively to instruction in the elements of mathematics, would not, we fear, create that continuity of interest which is necessary to the success of such an undertaking; notwithstanding the many works now published upon those subjects, it is possible to render many branches much simpler and easier to be understood, than in the form in which they are usually exhibited; but a work of this description must be executed by one thoroughly versed in mathematical science, though he only undertakes to explain the leading principles.*

H. S.—C. M. X., *and* B. O., *in our next.*

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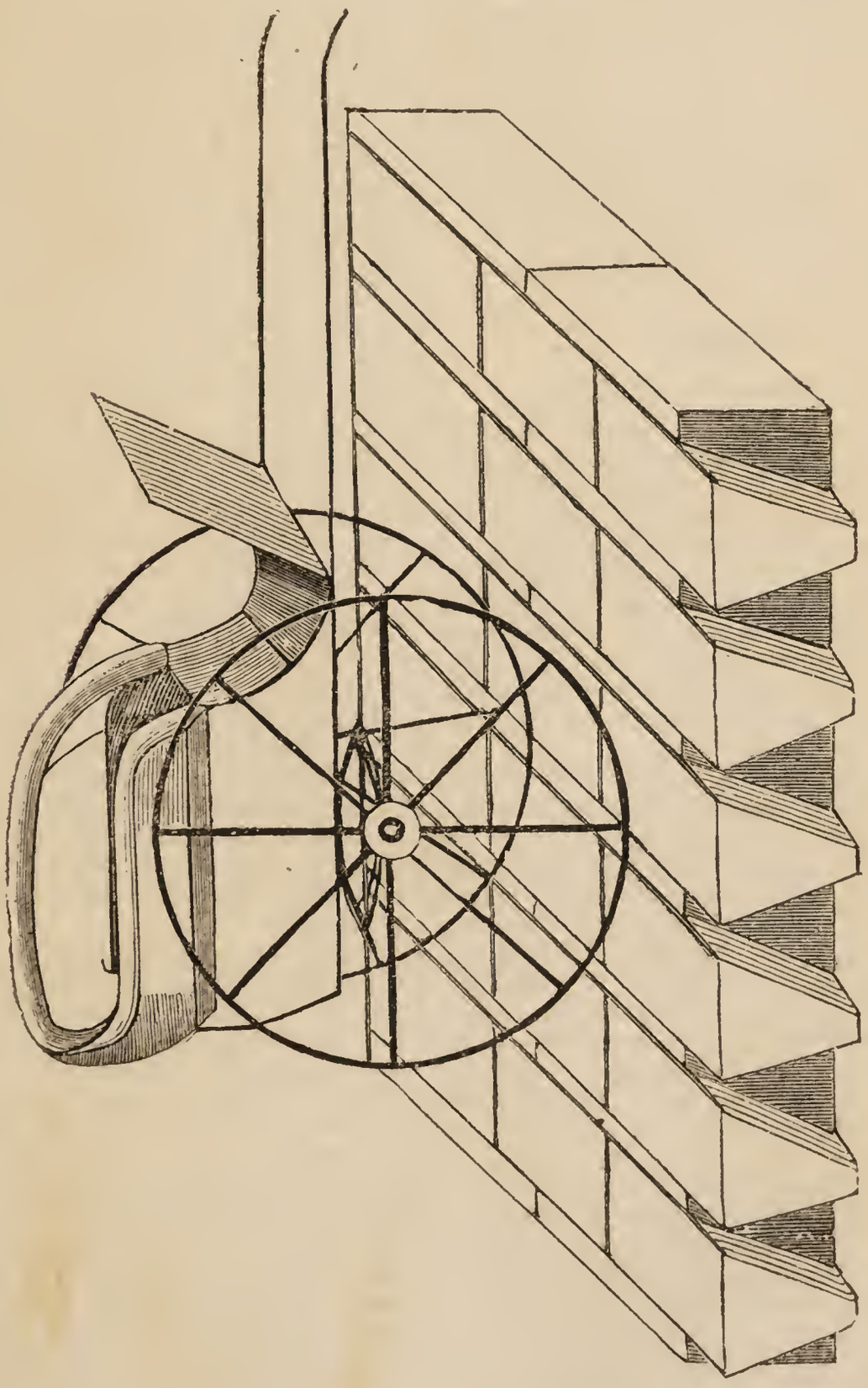
SCOTT'S IMPROVED WOOD PAVEMENT.



VOL. V.—No. 10.

City Press, 1, Long Lane, Aldersgate Street : D. A. Doudney

WOOD PAVING.

To the Editor of the Mechanic and Chemist.

(See Engraving, front page.)

Sir,—I take the liberty of sending you a drawing of some wooden block paving, which I have been led to consider the subject of, by observing the manner in which a great part of that I have seen laid down sinking so much, as to be not only unsightly, but making a very indifferent road for travelling, and which it must always do, should its foundation be less solid in one part than another, on account of their form. In the one I propose, it be perceived, that the form of the blocks, and being put together in the manner shown in the drawing, prevent the possibility of such an occurrence; as the greater the pressure the greater the strength and solidity. Should you think this worthy of insertion, you will oblige by so doing.

I remain yours, &c.

W. Scott.

Walworth.

THE ECCALEOBION.

That eggs should be hatched by exposure to a proper temperature, artificially produced, is a circumstance which adds but little to the wonders exhibited by the incomprehensible process of nature; it is well known that the ostrich deposits its eggs in the sand, where life is developed by warmth which does not proceed from the parent; and in Egypt, artificial incubation is practised to a surprising extent. Mr. Bucknell, in his treatise on the eccaleobion, &c., says,

"The Egyptians imitate the ostrich; they arrange eggs in *mammals*, or ovens, built in such a manner as to give to the eggs the necessary protection from the slight atmospheric changes of their almost unvarying climate; and a small fire, running lengthways through the different compartments, maintained for the first eight or ten days, is sufficient to promote incubation; the loss of heat from radiation during the remaining days of the process, owing to the genial nature of the clime, being so trifling as not to destroy the vitality of the egg.

"Under circumstances so peculiarly favourable, it is nevertheless a task of no ordinary difficulty, and which, requiring the most minute care and attention on the part of the operator, is practised only by a few individuals; these inhabit a particular village, named Bermé, situated in the Delta of the Nile, about sixty miles from Grand Cairo, and by teaching the secret to their children, these Bermeans perpetuate the practice of their art. It is, however, only during the serene autumnal months, that they will venture upon the performance of this curious business, at which time, scattering themselves over the whole land of Egypt, they bring into existence, under the supervision of the government, the enormous and almost incredible number of above ninety-two millions of various kinds of poultry. The ovens being limited to three hundred and eighty-six, and the business monopolized by the government, we may conclude this estimate a near approximation to the truth."

This process, with such additions as were suggested by the less genial climate of Europe, has been tried at different periods, and in different countries, with partial success; but no result has been obtained, so satisfactory as to lead to its general adoption as a means of increasing the production of poultry for useful purposes, until the eccaleobion was invented by Mr. Bucknell. This apparatus is thus described by the inventor:—

"The eccaleobion, or life-giving machine, forms, to outward appearance, an oblong, square, wooden box, about nine feet in length, three feet in breadth, and three feet and a half in height, covered, excepting the doors, with cloth. It stands upon a table, and is entirely disconnected from the walls against which it is placed. Its efficient action and regulative power are inclosed within.

It is divided into eight compartments, or divisions, open to the sight (the doors being glazed) in which the eggs are deposited, spread promiscuously upon the floor of each division. The eggs lie uncovered, neither wrapped in flannel, nor immersed in sand, as has usually been done, in order that they might retain their warmth when exposed to cold, or resist the effects of too great heat.

"The eccaleobion is capable of containing upwards of two thousand eggs;—each egg has the power of generating heat, as the bird within it advances to maturity; consequently, a very successful issue, from a large number of eggs, can be expected only when such quantity is subjected to an uniform action of the machine, regulated according to the degree of heat engendered by the birds. Or, in other words, the degree of temperature suited and administered to a thousand eggs, during the last week of incubation, would not elicit life in a thousand fresh eggs, submitted to the same influence; while the temperature, necessary to produce life in the latter, would destroy it in the former.

In consequence of this physical law, a great sacrifice of life is incurred in the endeavour to bring a large number of birds daily into existence; nevertheless, by using certain counteracting measures while eggs can be obtained plentifully and good, the average will exceed one hundred daily —or, about 40,000 per annum."

The time of incubation varies with different birds; the swan requires 42 days, and is said to live 200 years; the goose 30 days, and lives 80 years; the hen 21 days, and lives 18 years; the canary 14 days, and lives 14 years. The eggs of different birds do not all possess the same nutritive property; it is observed by a French writer, that if we harden in boiling water the eggs of young hens, in which the yolk is usually a pale yellow; those of a guinea hen, which have the yolk of a saffron colour; and some ducks' eggs, in which the yolk is a deep red-yellow: and if we afterwards take equal weights of each of these yolks, and extract the oil from them in the usual manner, we shall obtain more oil from the yolks of the guinea hen, than from those of the pullet, and most of all from those of the duck: from which ex periment it may be concluded, that the yolk owes its colour in a great measure to the oil it contains.

The albuminous cords which connect the yolk with the white, have been variously designated by vulgar error; but they are not the source of vitality, as commonly supposed, and are found in unimpregnated eggs as perfectly developed as in those which are impregnated. They are not generally of the same magnitude, that extending towards the great end of the egg being larger than the other which lies next the small end of the egg. Sometimes one of these cords is wanting; but this happens more frequently in the eggs of guinea fowl, than in those of the common hen.

The process of incubation is beautifully displayed upon the table of Mr. Bucknell's exhibition room, from the first spark of visible life, to the formation of the perfect chicken. We extract the following description from Mr. Bucknell's treatise:—

"The following progressive series of phenomena are daily observable during the process of incubation, in the egg of the common fowl:—

"In an impregnated egg, previous to the commencement of incubation, a small spot is discernible upon the yolk, composed, apparently, of a membraneous sac, or bag, containing a fluid matter, in which swims the embryo of the future chick, and seemingly connected with other vesicles around it.

"1st Day.—In a few hours after exposure to the proper temperature, the microscope discovers that a humid matter has formed within the lineaments of the embryo; and, at the expiration of twelve or fourteen hours, this matter evidently bears some resemblance to the shape of a little head; a number of new vesicles also successively appear, rudimentary of different parts of the future body of the chick; those first formed, and most easily distinguishable, may afterwards be recognized as assuming the shape of the vertebral bones of the back.

"2d Day.—The eyes begin to make their appearance about the thirtieth hour, and additional vessels, closely joined together, indicate the situation of the navel. The brain and spinal marrow, some rudiments of the wings and principal muscles become observable. The formation of the heart is also evidently proceeding.

"3d Day.—At the commencement of the third day, the beating of the heart is perceptible, although no blood is visible; a few hours, however, elapse, and two vesicles, containing blood, make their appearance,—one forming the left ventricle, the other the great artery. The auricle of the heart is next seen, and, in the whole of these, pulsation is evident.

"4th Day.—The wings now assume a more defined shape, and the increased size of the head renders the globules containing the brain, the beak, and the front and hind part of the head, distinctly visible.

"5th Day.—On the fifth day the liver makes its appearance, and both auricles now plainly seen, approach nearer the heart than they were before: that beautiful phenomenon, the circulation of the blood, is evident.

"6th Day.—The lungs and stomach are distinguishable, and the full gush of blood from the heart distinctly apparent.

"7th Day.—During this day, the intestines, veins, and upper mandible, become visible; and the brain begins to assume a consistent form.

"8th Day.—The beak, for the first time, opens, and the formation of flesh commences upon the breast.

"9th.—The deposition of matter, forming the ribs, takes place, and the gall-bladder is perceptible.

"10th Day.—The bile is now formed, or, at least, distinguishable by its green colour; and the first voluntary motion of the body of the chick is seen, if separated from its integuments.

"11th Day.—The matter forming the

skull now becomes cartilaginous, and the protrusion of feathers evident.

"12th Day.—The orbits of the sight are now apparent, and the ribs are perfected.

"13th Day.—The spleen gradually approaches to its proper position in the abdomen.

"14th Day.—The lungs become inclosed within the breast.

"15th, 16th, and 17th Days.—During these days, the infinity of phenomena in this wonderful piece of vital mechanism elaborate it into more perfect form, and it presents an appearance closely approaching the mature state. The yolk of the egg, however, from which it derives its nourishment, is still outside the body.

"18th Day.—On the eighteenth day, the outward and audible sign of developed life is apparent, by the faint piping of the chick being, for the first time, heard.

"19th, 20th, and 21st Days.—Continually increasing in size and strength, the remainder of the yolk gradually becomes inclosed within its body; then, with uncommon power for so small and frail a being, it liberates itself from its prison in a peculiar and curious manner, by repeated efforts made with its bill, seconded by muscular exertion with its limbs, and emerges into a new existence.

"The position of the chicken in the shell, is such as to occupy the least possible space. The head, which is large and heavy in proportion to the rest of the body, is placed in front of the belly with its beak under the right wing; the feet are gathered up like a bird trussed for the spit, yet, in this singular manner, and apparently uncomfortable position, it is by no means cramped or confined, but performs all the necessary motions and efforts required for its liberation, with the most perfect ease, and that consummate skill which instinct renders almost infallible.

"The chicken, at the time it breaks the shell, is heavier than the whole egg was at first.

"An egg will not hatch in vacuo."

The eccaleobion is now exhibited at No. 121. Pall-mall; and we strongly recommend our readers to visit it, being convinced that very few can spend an hour in that place, without obtaining a valuable addition to their stock of knowledge.

COAL, IRON, AND STEAM.

It has been calculated, that in this country about fifteen thousand steam-engines are daily at work. One of those in Cornwall is said to have the power of a thousand horses; the power of each horse, according to Mr. Watt, being equal to that of five and a half men. Supposing, then, the average power of each steam-engine to be that of twenty-five horses, we have a total amount of steam power equal to that of about two millions of men. When we consider that a large proportion of this power is applied to move machinery, and that the amount of work now done by machinery in England has been supposed to be equivalent to that of between three and four hundred millions of men by direct labour, we are almost astounded at the influence of coal and iron and steam upon the fate and fortunes of the human race. "It is on the rivers," says Mr. Webster, "and the boatman may repose on his oars. It is in highways, and begins to exert itself along the courses of land conveyances. It is at the bottom of mines, a thousand" (he might have said one thousand eight hundred) "feet below the earth's surface. It is in the mill, and in the workshops of the trades. It rows, it pumps, it excavates, it carries, it draws, it lifts, it hammers, it spins, it weaves, it prints."

We need no further evidence to show that the presence of coal is, in an especial degree, the foundation of increasing population, riches, and power, and of improvement in almost every art which administers to the necessities and comfort of mankind. And however remote may have been the periods at which the materials of future beneficial dispensations were laid up in store, we may fairly assume, that besides the immediate purposes effected at or before the time of their deposition in the strata of the earth, an ulterior prospective view to the future uses of man, formed part of the design with which they were, ages ago, disposed in a manner so admirably adapted to the benefit of the human race."—*Buckland's Bridgewater Treatise.*

HINTS ON HEALTH.

(From Tilt's Table Almanack.)

January.—The invalid should watch with anxious solicitude the beaming of the mid-day sun, and seize upon so favourable an opportunity for taking exercise at short periods in the open air. The healthy should do so likewise, as by such means alone the body becomes invigorated, the mental powers increased, and the mischievous tendency to taking medicine frequently avoided.

February.—The exhilirating impressions produced upon the mind, by the increasing powers of the sun's rays during this month, should not induce the infirm of health to prolong their daily walk be-

yond noon. Let the dyspeptic dine at two, and employ himself with amusements congenial to his mind ; if they are not of a sedentary nature, so much the better.

March.—March air has, unfortunately, ever been decried as injurious to the sickly, unless the stomach is well fortified by some warm potation to resist the rude attacks of Boreas. Gentle aperients taken during the mild weather, are calculated to be of much more essential service.

April.—Any sudden transition from established habits is extremely injudicious ; this maxim applies to those who have during the winter indulged in warm clothing, and are now anxious to alter their habits without preliminary preparation. All who value their health should be careful to premise a draught or two of gentle medicine previous to any abridgment in their clothing.

May.—Every body should now avail themselves of that most salutary and natural exercise, walking; by means of which the appetite and perspiration are greatly promoted, the mind enlivened, and the motion of the lungs facilitated. No one can reasonably expect to enjoy life who neglects it.

June.—Such as are troubled with acidities, or whose food is apt to sour on the stomach, should avoid eating raw vegetables, which are now abundant and most inviting. Children of full habit will be much benefitted by a couple of doses of mild purgative modicine, such as calomel two grains, combined with julap six grains, and ginger two grains, followed by the usual black dose, as a preventive to gooseberry fever.

July.—The sea-side is now the favourite resort of many. Those who are subject to colds or coughs, or whose stomachs are weak, with loss of appetite, should begin with the tepid bath, and gradually decrease the temperature. By such means the body will become less susceptible of cold, and sea-bathing will be found of essential service when otherwise it would have been prejudicial.

August.—The liability to contract bowel complaints should render every one cautious how they indulge in watery liquors, salads, and raw fruits. Mild doses of rhubarb and magnesia, with two drops of the oil of carraway or cloves, taken twice a week, will be found the best means of regulating the bowels, and sheathing them from the acrid bile, which is now secreted in greater quantities.

September.—Man too frequently indulges in every species of food, and seizes upon every opportunity to gormandize : whilst such is the case, his ailments will not diminish. Stone fruits should be taken with precaution ; if griping pains are occasioned, calomel four grains, followed by a table-spoonful of castor oil, with five drops of laudanum, is the best remedy. Repeat this if necessary.

October.—Those who have accustomed themselves to bathe during the summer, may now substitute salt and water, rubbing dry with a coarse towel. Remember that colds are now prevalent, and beware of foggy nights. The gouty, the dyspeptic, and the rheumatic, should guard against the vicissitudes of our temperature by consulting the thermometer, in preference to the looking-glass.

November.—The excessive humidity of the weather in November, produces in the inactive mental disquietude, frequently laying the foundation of nervous diseases ; to prevent which, recourse should be had to exercise, equal clothing, and temperance in diet, avoiding the momentary excitement of cordials and other stimulants, temporarily effective, but permanently injurious.

December.—Great precaution should be taken by invalids, lest their maladies increase during this season of joy and festivity, when the animal system is apt to become replete. Let the gouty and rheumatic bear this in mind, and counteract the effects of feasting, by exercise in the open air, in preference to the warm fireside and luxurious sofa, with that bane to health—a newspaper.

THE CHEMIST.

ACIDS.

NO. V.

Chloriodic Acid may be obtained by passing chlorine into a vessel containing iodine : it is quickly absorbed, and a compound obtained, which is brown, when the iodine is in excess ; colourless when exactly saturated ; and yellow, if there be excess of chlorine. It is volatile, and may be distilled without decomposition. It tastes sour, and powerfully reddens litmus ; it attracts moisture from the air, and dissolves readily in water. It appears to decompose the water, and form hydrochloric acid, and a compound of iodine and oxygen ; but these combinations are not permanent.

Iodous acid is best obtained by introducing a mixture of one part of iodine and three parts of chlorate of potassa into a retort, and rapidly applying heat ; a dense

fluid passes over, which should be collected in a receiver cooled by a freezing mixture. It has a pungent taste, and a peculiarly disagreeable odour. It reddens litmus, and forms a yellow solution when diluted with water. It slowly evaporates when exposed to the air, and rapidly volatilizes at 212°. It is decomposed by sulphur, disengaging a little heat, and liberating violet vapours: sulphurous acid also decomposes it. Phosphorus and potassium are instantly inflamed by it. It dissolves iodine.

Iodic acid is procured by acting upon protoxide, or peroxide of chlorine, by iodine; for this purpose the iodine may be introduced into a small flask, the oxide of chlorine disengaged upon it, from a mixture of chlorate of potassa and sulphuric acid, or 100 grains of chlorate of potassa, may be introduced into a small retort with 400 grains of liquid muriatic acid of the specific gravity 1·105; annex to the retort a small globular receiver (the receiver must have a bent tube issuing from it, and passing from the bottom of it to a small flask containing the iodine, about 50 grains), carefully apply the heat of a lamp to the retort, by which the oxide of chlorine will be disengaged, and which will be absorbed by the iodine. The aqueous solution of iodic acid first reddens, then destroys vegetable colours. Nitric, sulphuric, and phosphoric acids, when dropped into a hot saturated solution of iodic acid, forms chrystallized compounds of a yellow colour. Muriatic and oxalic acids decompose it. Its compounds are called *iodates*.

Hydrobromic acid gas may be obtained by acting upon bromide of potassium by sulphuric acid. This gas is colourless, sour, of a pungent and highly irritating odour, and yields dense vapours when mixed with humid air. It undergoes no change when passed through a red-hot tube, either alone or mixed with oxygen or iodine, but chlorine decomposes it, producing vapour and drops of chlorine. The attraction of oxygen and of bromine for hydrogen, is probably nearly equal, for bromine does not decompose water, nor does oxygen decompose the hydrobromic acid. Hydrobromic acid gas is rapidly absorbed by water; heat is evolved, and a fuming liquor obtained, which is colourless when pure, but which readily dissolves bromine, and acquires a yellow colour. This acid may also be obtained by the action of sulphuretted hydrogen on bromine and water. The liquid hydrobromic acid is instantly decomposed and discoloured by chlorine. Nitric acid also decomposes it, produces the evolution of bromine, and the formation of water and nitrous acid. This mixture dissolves gold. Its salts are termed *hydrobromates*.

MISCELLANEA.

Scent of Plants.—The scent of some plants is not perceptible until after they are cut down and exposed to the influence of either the sun or artificial heat. Grass, while growing, possesses no particular smell, but when made into hay, it scents the country around. The wood of the ash tree, when burned in a green state, will emit a fragrance like that which proceeds from the violet and mezerion, and this it will diffuse to a very considerable distance. The glands of the frascinella, from which it exhales its scent, are large enough to be seen by the naked eye, and the vapour is so combustible, that it will burn when a light is placed within its influence. The garden nightshade has the property of causing sleep to overpower those who may inhale its odour; and the upas tree possesses an uncommonly deleterious quality of vapour. Some flowers emit their odours only at certain periods. Those having an ambrosial smell exhale only after sunset, and the appearance of some plants corresponds with the nature of their scent. Musky-scented flowers are always of a yellowish and purple colour, and a dull appearance is indicative of the deleterious nature of their perfume. The odour of plants and flowers, which seems thus to inherit the property of creating such a diversity of feelings in the human frame, is considered by naturalists to be an excretory secretion, forming a gas or vapour, which in some is supposed to proceed from the petals transmitted from the plant by the claws at its base, and escaping through orifices on their surface, at others from the nectaries, or various parts which compose their blossoms.

The Typoface.—The Bordeaux papers mention that a young sculptor of that city has discovered a method of taking casts of the human face, which, without requiring that the features should be reduced to a state of perfect rigidity, allows them to preserve all their natural play, and thus produces an exact resemblance with the animation of life. His name is Pellet, and he designates his apparatus the "Typoface."

Improvements in the Daguerreotype.—The means have just been found of engraving the Daguerrotype drawings, and of engraving them on the spot. This very important discovery is due to Dr. Donne, who has had the felicitous idea of applying the ordinary process of engraving directly to the proofs taken with the Daguerreotype. However extraordinary this result looks at first sight, it is not the less certain and authentic. We have examined the first plates obtained by that able observer. They have been submitted to the Academy of Sciences, where they have caused a very great sensation. Dr. Donne's discovery appears to us almost as important as that of the Daguerreotype itself. When he shall have brought to perfection his engraving process, then only will the Daguerre apparatus prove to the traveller, antiquary, and naturalist, the most valuable resource. When the image of the most

complex monument or most minute preparation of natural history shall have been finished, every traveller or observer, by immediately engraving the plate, will be able to compose himself the picturesque part of his work, and to multiply its proofs at a cheap rate. The primitive art, which obliged us to make collections of unique pictures upon silver plates, is therefore about to take a far wider range. It will quit the cabinets of the curious, and enter the domain of the graphic arts in general, and of popular education.—*Paris paper.*

New Musical Instrument.—One of the most ingenious musical instruments for years presented to the public, has been lately invented by Mr. Jenkinson, the organist of Lurgan church. The principle, though not altogether novel, is improved upon in a manner quite unique. It consists of a large violin body without neck or finger-board, placed horizontally on a frame, having a greater number of strings than the violoncello, which are acted on by a bow at the one end, and a key-board, as in the pianoforte, answering to the left hand of the violin player The entire of the strings are at once under the movement of the bow; and, to avoid the discordant effect which must ensue when the piano tone is required, any string is made removeable at pleasure from the touch of the bow, by the simple contrivance of a few treddles, wrought with the foot and connected with a damper in the inside of the instrument. One great beauty of the invention is, that by the judicious disposition of the stops, each one produces the full chord of any key in which the performer thinks proper to play. The tone is most powerful; and, from the vast variety of notes capable of being produced, it forms one of the best orchestral instruments which we have seen. The writer heard it accompanying a grand piano, and the tone of the latter in some instances was wholly drowned by the strength of Mr. Jenkinson's instrument.—*Belfast News Letter.*

To discover whether Flour be Adulterated with Chalk or Whiting.—Mix with the flour some lemon or good vinegar; if the flour be pure, they will remain together at rest, but if there be a mixture of whiting or chalk, a fermentation or working like yeast will ensue. The adulterated meal is whiter and heavier than the good. The quantity that an ordinary tea-cup will contain, has been found to weigh more than the quantity of genuine flour by four drachms.

Steaming and Staging.—According to a statement in the *Railway Times*, it would not at first sight appear that so extensive an injury as might have been expected, has been done to stage-coach travelling by the competition of railways. That paper states the "official returns" to show that the combined duty received from stage carriages and railways for the year ending 5th of January, 1835, amounted to 487,823*l.* while for the year ending 5th of January, 1839, it reached to 494,284*l.*, the increase from the one kind of travelling having exceeded the decrease on the other. Thus, in 1835, the stage-carriage duty amounted to 486,892*l.*, and in 1839 to 454,714*l.*, leaving a deficiency of 32,178*l.*; whereas the railway duty was in 1835 only 931*l.*, and in 1839, 39,570, being an increase of 38,639*l.* It must be remembered, however, that although the reduction of the coach duty is small in reference to the whole amount, it has fallen only upon particular lines of road, and there its pressure upon the property invested must have been very severe.

Learning, if rightly applied, makes a young man thinking, attentive, and industrious, confident, and wary: an old man, cheerful and reserved. 'Tis an ornament in prosperity, a refuge in adversity, an entertainment at all times; it cheers insolitude, and moderates upon a throne.

White Teeth.—The following is strikingly illustrative of the acute perception of the blind. The celebrated Saunderson, although completely blind, and who occupied in so distinguished a manner the chair of mathematics in the University of Cambridge, being one day in a large company, remarked of a lady who had left the room, but of whom he had never before met, nor even heard of, that she had very white teeth. The company were extremely anxious to learn how he had discovered this, for it happened to be true. I have no reason," said the Professor, " to believe that the lady is a fool, and I can think of no other motive for her laughing incessantly as she did for a whole hour together."

Rob Roy's Violih.—A gentleman in the neighbourhood of Kinross has an old violin, which was long in the possession of a Highland gentleman of Perthshire, well known in his day for his musical talent. On the inside is written " Robert Roy Macgregor, 1660."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Nov. 6, A. J. Mason, Esq., Sketches of the United States, Geographical, Political, and Moral. Friday, Nov. 8, B. R. Haydon, on the History of Art, from the earliest time. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 7, Edward Taylor, Esq., Gresham Professor of Music, on Vocal Harmony. To commence at eight o'clock.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Nov. 8, G. F. Richardson, Esq., (of the British Museum), on Corals. At half past eight.

QUERIES.

Is there any method of colouring hair (say red, for instance), so as to leave it nearly white?—Of what materials are the small models of the Egyptian obelisks made (I believe the black is coal), and the manner of manufacturing them.

C. M. X.

If 12 quarts of wine be taken out of a wine tub, and 12 quarts of water be poured into it; if this operation be repeated four times, and if there then remain 51 quarts of pure wine in the tub, what was the original quantity contained therein?

B. C.

The best and easiest method of dyeing various parts of white silk crimson and Prussian blue?

S. G. S. F.

1. How is the expansion of water, both by heat and cold, to be reconciled, or how explained? 2. At what rate does air expand, and at what temperatures? 3. In what proportion does the mercury in the barometer sink, in ascending the air; and supposing the mercury stood at 32°, what would be the actual height of the instrument? 4. In what proportion does the heat increase towards the centre of the earth? What loss of power is generally allowed for friction in machinery? 6. How is the power of an hydraulic press computed; suppose, for instance, the diameter of cylinder was 16 inches, and the height of column of water 6 feet, what would be the force exerted? 7. The standard for levelling is low-water mark; how is this found? D. J.

The process of making carmine from the cochineal insect? A SUBSCRIBER.
Chelsea.

ANSWERS TO QUERIES.

To obtain a Persulphate of Iron.—"Juvenile Entertainer." I think *per*sulphate of iron, not *pre*sulphate. I never heard of the latter. I send the mode of preparing the persulphate:—Dissolve the moist red oxide of iron in sulphuric acid, and the product will be persulphate of iron. It may be also formed by adding sulphuric acid to the solution of the sulphate of iron, heating the mixture, and dropping into it nitric acid sufficient to peroxide the salt. It does not crystallize, but affords, by evaporation, a brown deliquescent mass. J. MITCHELL.

The preparation of Lutes.—Under the term *lutes*, a variety of compounds are used by the practical chemist for the purpose of securing the junctures of vessels, or protecting them from the action of heat. Glaziers' putty is a very good lute for all the common purposes of a laboratory; but it is necessary that the whiting be first thoroughly dried before it is mixed with the oil. Linseed oil and sifted slaked lime, well mixed and made thoroughly plastic, form an excellent coating for retorts; if made thicker, this mixture is an impenetrable luting, that is not liable to crack. A mixture of four parts sand and one of common clay, was recommended by Dr. Black as a good common lute, except where it is to be exposed to an intense heat; in such situations, he advised to use six parts of sand and one of clay. A mixture of martial pyrites and muriate of ammonia, forms a good lute for stopping the cracks of iron utensils; but the following artificial compound is preferred, on account of the proportion of the ingredients being more exactly ascertained:—To two pounds of iron turnings or filings add one ounce of sal ammoniac, and one ounce of flour of sulphur; blend the mixture with water till the whole of it is of a proper consistence. This lute is employed by engineers to stop the joints of steam engines, &c. A mixture of salt and whiting, kneaded with water, makes a very hard and durable lute for many purposes, particularly for securing the joints of the apparatus for the production of carburetted hydrogen. Slips of wetted bladder, or a paste made of linseed meal and water, forms a very useful lute.
J. MITCHELL.

To make an Infusion of Gentian—"F. F. F." Sliced gentian root, half an ounce; dried bitter orange peel and coriander seeds, of each one drachm; boiling water, twelve liquid ounces. Macerate one hour in a lightly-covered vessel, and then strain.

To make Boots Waterproof—"W. J." Dissolve India-rubber (cut into small pieces) in spirit of turpentine, by placing the phial, or small jar containing it, in a saucepan of water over the fire, and stirring or shaking it occasionally. When perfectly fluid, apply it warm to the boots, with a piece of flannel or rag, till the leather appears saturated, and they will resist snow or water. It should not be very thick or cool, or it will remain on the surface instead of penetrating the leather. The smell of the turpentine will soon pass off on exposure to the air.

To Varnish the Silk of a Balloon.—"G. H. S." Dissolve Indian-rubber in five times its weight of oil of turpentine, and this solution again dissolved in eight times its weight of drying linseed oil by boiling. DISCIPULUS.

TO CORRESPONDENTS.

H. S.—*The length of a pendulum vibrating seconds* in the latitude of London, *is* 39.2 *inches. The time of an oscillation varies as the square root of the length of the string; but if the force of gravity (which varies in different latitudes) be not given, the time of an oscillation varies as the square root of the length directly, and as the square root of the force of gravity inversely.*

W. J. Cuthbert *in our next.*

T. S. J.—*His suggestions shall not be disregarded; but we still are of opinion, that numbering queries and answers would be less convenient than repeating the object of enquiry at the time it is answered, which renders the subject intelligible, without the necessity of referring to former numbers. We thank him for his good wishes, and feel flattered by the terms in which he expresses his approbation.*

Proportio—*The delay which occurred in the insertion of his last article on architecture was occasioned by the engraving, which is more than usually complicated. We take this opportunity of thanking him for his interesting papers, and expressing a hope that he may long continue a correspondent of the "Mechanic."*

H. B. I. *will find several receipts for dying hair black in the last volume of the "Mechanic." Nitrate of silver (lunar caustic) will produce that effect, but it also stains the skin, and almost everything it touches. It will even stain a common flint, and figures have been formed by this means, which have passed with connoisseurs for natural* veins *called* lusus naturæ.

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THE

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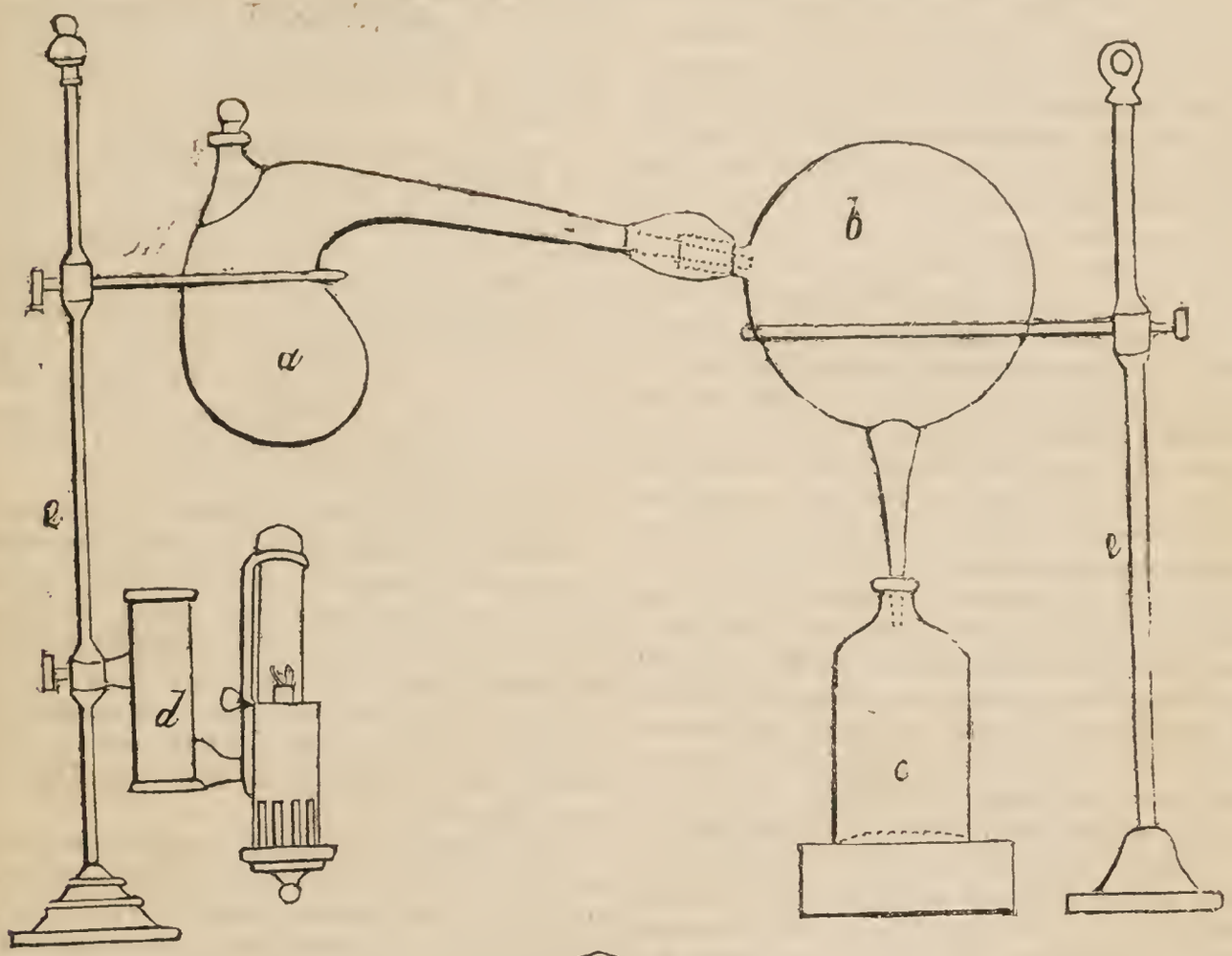
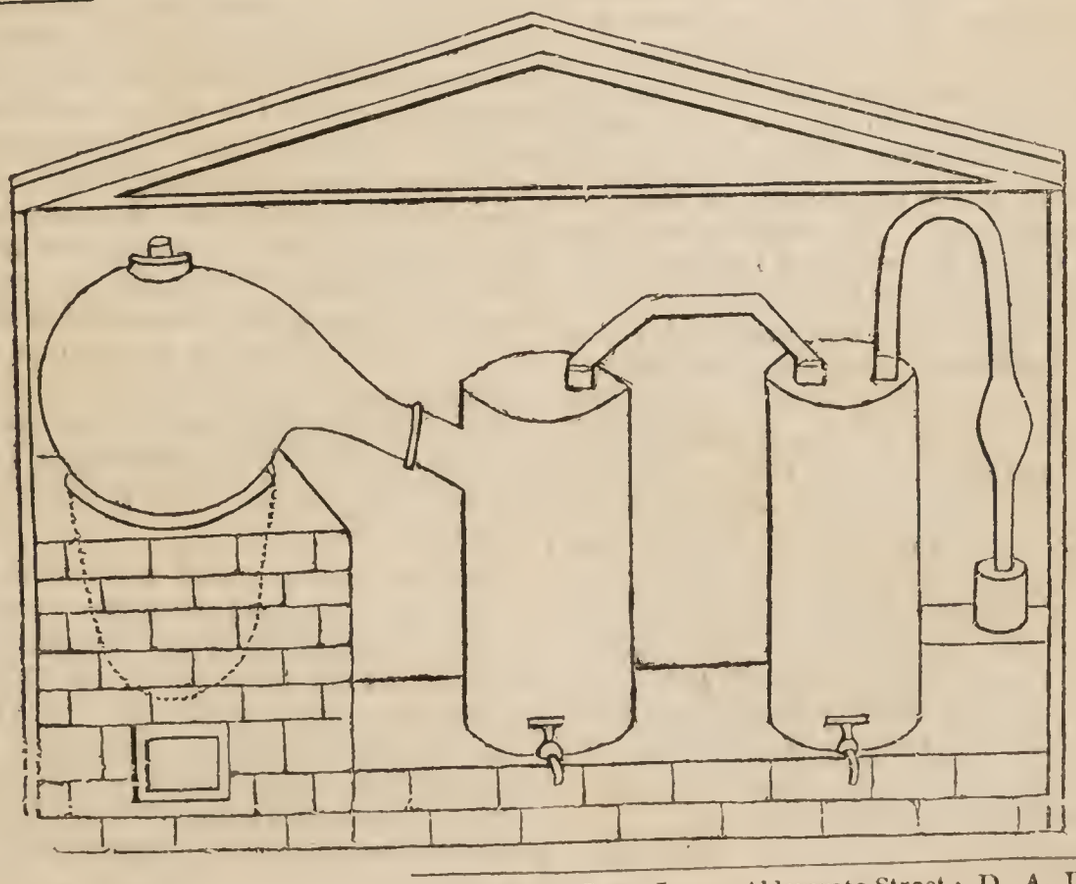
MITCHELL'S APPARATUS FOR MAKING NITRIC ACID.





VOL. V.—No. 11.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney

LOCOMOTIVE POWER APPIED TO CANAL TRANSIT.

A short time ago an experiment was conducted on the Forth and Clyde Canal, of a novel and highly interesting nature, by John Macneil, C. E., and consulting engineer to the Canal Company. It is well known that the haulage of boats on this canal has hitherto been performed by horses, the rates of speed being for the heavy sloops, brigs, &c., in the London, Dundee, and other trades, about one and a half to two miles per hour, when drawn by two or five horses, according to the state of the weather, and for the swift or passenger boats, between eight and nine miles an hour on an average, when drawn by two horses. The object of the experiment was to ascertain the possibility of using locomotive steam power to draw the boats instead of horses; accordingly a single line of rails upon blocks, like an ordinary railway, was laid down for a considerable space along the canal banks, near lock 16; and a locomotive engine and tender, built by Mr. Dodds, having been brought down the canal and set on the rails, on the morning of the 21st, Mr. Macneil, Mr. Johnson, the canal director, and several engineers and gentlemen being present, the experiment commenced by attaching to the engine the towing line of the first passenger boat that made its appearance, and which contained upwards of ninety passengers, with their luggage.

There was a trifling delay in disengaging the horses and tying the line to the engine, but this was amply compensated when the *Victoria* briskly set off, and almost immediately gained a speed of seventeen and one-third miles per hour, which she kept up round two curves, and until the termination of the rails made it necessary to stop, amid the cheers of the delighted passengers. This experiment was repeated during the course of the day, with each passenger boat as it came to the railed space, and with equal success each time. On one occasion a towing-rope, which was much decayed, got foul with a curb-stone and broke, but without causing the slightest inconvenience, except about one minute's delay. The engine employed being intended only for a slow trade, was not calculated to go at greater speed than eighteen miles per hour, but it was the opinion of all present, that with proper passenger-locomotives, a speed might be obtained equal to that upon the best railways, few of the latter possessing the advantages secured by the canal bank of a perfect level throughout.

The nature of the motion was highly gratifying to all the passengers, being more uniform, steady, and smooth, than when the boats were drawn by horses.

Several of the heavy (masted) vessels were also taken in tow during the two days of trial, at the rates of three, three and a half, four, and five miles an hour; and, on one occasion, two loaded sloops, and a large waggon boat, were together attached to the engine, and hauled with ease at the rate of two and three quarters miles per hour, whilst only one-fourth of the steam was allowed to pass the throttle valve.

The foregoing statements render palpably apparent the immense advantages which might be gained by this new adaptation of steam power—a great economy in haulage expenses, as one engine might draw at least six sloops, which now would require from eighteen to twenty-four horses, and, if necessary, at double the present speed; and a proportional increase of the important traffic on the canal, which might be reasonably expected.

Passengers would increase in great proportion when attracted by economy and speed of transport. The Union Canal might be traversed in two hours, and the Forth and Clyde Canal in one and a half, instead of four hours and three and a half, as at present, and this by only assuming sixteen miles per hour, though more might easily be performed, as the experiments have shown.

The foregoing is from the *Glasgow Courier*; it is much to be regretted that newspapers in this country should be so deplorably deficient in scientific knowledge, as they almost all appear to be. We should have deemed the proposal of dragging barges through the water with a speed equal to that of trains on the best railways, sufficiently monstrous for any sober Scotchman; but when we are told that few railways possess the advantage of *a perfect level throughout*, "secured by the canal bank," although the experiment is stated to have been tried at the sixteenth lock, which implies considerable deviation from the horizontal line, we are inclined to suspect that the article was intended for the sister island, or the slick citizens of New York.

The subject of canal conveyance is one of great importance, and has recently occupied the attention of the French Academy. At the meeting of the 14th of October, the indefatigable M. Arago communicated to the learned assembly, a letter from Mr. Robinson on the subject of the experiments above described. It has been found that much advantage is obtained by

maintaining a great speed in canal boats, so as to prevent the formation of the wave which, at low speeds, is observed before the boat, extending to, and injuring the banks, as well as impeding the progress of the vessel. These experiments have been repeated in France, and there is now a regular conveyance of this kind established on the canal de l'Ourcq, between Paris and Meaux. The horses employed must be well taught to start without hesitation, and continue without any diminution of speed; for if the wave is once formed, it cannot be surmounted without great difficulty during the remainder of the passage. The steam locomotive possesses the requisite properties for this object; but it is a question worthy of consideration, whether, in many cases, it would not be more advantageous to place the engine in the boat, when an unobjectionable mode of propulsion is devised.

THE LIONS OF LONDON.

It has long been matter of regret to the lovers of science and art, that our national exhibitions were so inaccessible to the mass of the people, while in France, and other foreign countries, they were open to all who chose to frequent them. The narrow-mindedness of past days is, however, fast passing away; and partly through the influence of private individuals, partly by the provisions of government, and by the exertions of a society formed for the express purpose of affording the greatest possible facility for viewing these collections of the wonders of nature and art, the doors of many of the national exhibitions are now accessible gratuitously, at all reasonable hours, and many others will soon be thrown open. The publisher inserts here for the information of his numerous readers, especially such as may have occasion to visit London, a short account of the above most excellent society, and a list of the places already open to the public.

Society for obtaining free access for the People to National Monuments, and to Public Edifices containing Works of Art.

President—His Royal Highness the Duke of Sussex.

Vice-Presidents.

The most Noble the Marquis of Westminster.
Right Honourable Lord Hatherton.
N. Ridley Coleman, Esq., M.P.
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The object of this society is to procure for the people opportunities of intellectual recreation, and thereby lead them from dissipation or idleness to the cultivation of their understanding, the refinement of their taste, and a due appreciation of merit.

The society to consist of subscribers of one guinea for the first year, and five shillings each succeeding year.

The annual meeting of the society to be held in April or May, for the election of officers and for general business. Other general meetings to be held monthly, from November to July, and the progress made by the society duly reported.

Persons desirous of joining the society, or of giving information of Museums and collections of art or natural history open to the public, are requested to communicate with some member of the committee, or with the Hon. Secretary, 7, Manchester-street, Manchester-square.

Ladies are especially invited to join a society so conducive to the extension of civilization among the people. A list of the members will be published with the annual report.

The public are already admitted without any payment to

The Tower of London.

The British Museum—Monday, Wednesday, and Friday, and the whole of Easter and Whitsun weeks except Saturday, from 10 till 4; from May to September, 10 to 7; closed the first week in January, May, and September, and on Christmas day, Good Friday, and Ash Wednesday.—Young children excluded on holidays.

National Gallery—Monday, Tuesday, Wednesday, and Thursday, and the whole of Easter and Whitsun weeks except Saturday, from 10 till 5; closed for six weeks from the end of the second week in September, and on Christmas day and Good Friday.

St. Paul's—Each week day from 9 to 11, and from 3 to 4; and on Sunday from 10 to 12, and from 3 to 5. Visitors when in, may remain till dusk on week days.

East India House Museum—Saturday, from 11 to 3; all the year except in September.

Soane Museum—Thursday and Friday during April, May, and June only, from 10 to 4. Tickets must be applied for previously, and will be sent by post.

Society of Arts—Any day except Wednesday, to strangers and mechanics.

Hampton Court Palace—Arrangements are being made to admit *freely* Monday, Tuesday, Thursday, and Friday.

Kew Gardens—Pleasure grounds, Sunday and Thursday, free, from 12 till sunset, from Midsummer to Michaelmas; the Botanical Gardens and Arboretum every day, to intelligent strangers, from 1 to 3, at any season.

Dulwich Gallery—Each week day, except Friday, from 10 to 5 in summer, and from 11 to 3 in winter. Tickets to be had gratis from the principal printsellers in London. Children under 14 jected to.

Norwich Cathedral—One hour each week day, in addition to hours of service.

Bath Cathedral—At all times.

Dover Philosophical Institution—Every Monday; principally Natural History.

Truro Museum—Daily; Minerals.

Royal Dublin Society—Museum and Botanical Gardens Tuesday and Friday; Gallery of Casts Wednesday and Saturday, from 12 to 4.

Edinburgh College of Surgeons' Museum—Four times a week.—*Noble's Compendium.*

DR. TURNBULL'S SUCCESS IN THE CURE OF DEAFNESS.

We paid Dr. Turnbull a second visit a few days since, and were extremely gratified. One case, in particular, came under our notice, in which, during a very short space of time—say ten or twelve minutes—we beheld a very obvious improvement. It was that of a young lady, probably about eighteen years of age, who had been both deaf and dumb from her birth. When she entered the room she could not hear a syllable which was uttered, nor did she recognize the least sound, though two books were struck violently against each other, close by her ear. We never saw a more lamentable deficiency in the organ of hearing. The Doctor resorted to his usual mode of restoration,—namely, pouring a small quantity of some liquid into the ear, and stirring it round the interior with a piece of soft leather;—having continued this for about five minutes, he repeated the experiment before alluded to, striking the book, however, much more moderately; this his patient heard; the Doctor then spoke to her, and she readily replied by signs that she heard and understood him. The first letters of the alphabet were now spoken one by one to her, and she, after a few efforts, repeated them with very tolerable accuracy, proving, beyond a doubt, that a great improvement had taken place.

Another case was that of an interesting little boy, about six years of age, named Wells, who was likewise deaf and dumb from his infancy. Through the instrumentality of Dr. Turnbull, hearing was in a great measure communicated, and the little fellow was enabled to utter many words with the greatest promptitude and clearness.

The variety of cases which come under the Doctor's notice, are singularly numerous and pleasing. One at the present time is that of a respectable family from Scotland, five of whom are deaf; another, that of a young gentleman of fortune, whose relatives have recently returned with him from Paris, where he has been under some of the most eminent physicians; the sight was peculiarly touching when the youth returned to the room where we were sitting, to meet those of his friends who had not attended him whilst under the Doctor's hands; perceiving how readily he replied to their first inquiries, they burst into tears of gratitude and joy, from a consciousness of the improvement which had been effected; another case—to mention no more—struck us as very peculiar; it was that of a man and his wife, who were both deaf and dumb, and whose only intercourse with each other was kept up by a rapid succession of signs made by their fingers. If we recollect right, they had three children, all deaf and dumb.

Highly pleased with what we have seen, we say to Dr. Turnbull, by way of concluding our remarks, "Go on, Doctor, and prosper!"

ANTHRACITE COAL.

At the recent meeting of the British Association, Mr. Player read the following paper on the application of anthracite coal to the blast furnace, steam-engine boiler, and smith's fire, at the Gwendraeth iron works near Carmarthen:—

The inconvenience of the fire choking for a long time baffled the experiments made on the subject, but it was at last obviated by heating the coal before it reaches the fire, which was accomplished by supplying it, without any mixture of coke or bituminous coal, through a per-

pendicular chamber placed centrally on the top of the boiler, with an opening about twenty inches in diameter immediately over the fire place. In passing through this chamber, by its contact with the plates, the coal acquires considerable heat, and descending by its own gravity, as the fire consumes beneath, replaces what has been burnt, by which means a regular supply of fuel is furnished, fit for immediate and complete ignition. Another inconvenience is also thus avoided, as fresh coal thrown upon the fire abstracts a quantity of heat from the fuel already in ignition, and checks the generation of steam. The fire is never meddled with; there are no fire drawers; there is no current of cold air passing through the flues, and a very small amount only of draught is required. One engine worked seventy-two hours consecutively, during which time the grate neither choked nor clinkered; nor was a bar used for the fire, or did there remain any considerable result in ashes. The coal was, in this instance, entirely anthracite (small, but not powdery) and tipped into the feeding chamber once every four hours. Water was also kept in the ash-pit, the steam from which, being decomposed by passing through the fire, the gas forms a jet of flame, creating another active source of power. On these works, there are in action upon this principle, five smiths' fires, the tool-maker's fire being blown by a 30-inch bellows only, whilst with this the largest squaring edges for the masons are made with ease. The coal is supplied through an upright brick flue, about three feet six inches high, two feet six inches long, and nine inches wide. The foundry has a similar arrangement, with merely the addition of a flue to take off the flame, the blast being cold, and worked by a small water-wheel, and by which iron is re-melted, running very fluid, and yielding an excellent quality. An oven has also been built for the use of the workmen, heated only with small culm, which succeeds admirably.

ZOOLOGICAL SOCIETY.

STRANGE, IF TRUE.—At the ordinary scientific meeting, on Tuesday evening, F. Wishaw, Esq., in the chair, the first communication read was a letter from Mr. Mackay, of the British consulate at Maracaibo, on a plant called Projojoy, in the country from which it was derived, and which arrives in this state from the strange metamorphose of an insect. In the insect which was described, some of the legs have been already changed into roots, and in this state it was presented to the contributor. It was announced that a similar insect had lately been discovered in North Carolina. When this creature assumes the form of an insect or animal, it is about an inch in length, and much resembles a wasp in appearance. When the insect has attained its full length, it disappears under the surface of the ground and dies, soon after which the two fore-legs begin to sprout and vegetate, the shoots extending upwards, and the plants in a short time reaching a height of six inches. The branches and the leaves are like trefoil, and at the extremities of the former there are buds which contain neither leaves nor flowers, but an insect, which, as it grows, falls to the ground or remains on its parent plant, feeding on the leaves till the plant is exhausted, when the insect returns to the earth and the plant roots forth again.

[We should feel particularly obliged to Mr. Mackay, if he would take this back and make some slight alterations in it, as it will be found difficult to persuade any one to believe it in its present state. This is not the first story of the kind we have heard; and we should be glad if any of our readers could suggest a reasonable explanation of the appearances which have led to so strange a statement.—ED.]

THE CHEMIST.

ACIDS.

NO. VI.

(See engraving, front page.)

Nitric acid is usually obtained by distillation of purified nitre with sulphuric acid, of which material different proportions are employed. The nitric acid of commerce, which is generally red and fuming, in consequence of the presence of nitrous acid, is procured by the distillation of one part of sulphuric acid with two parts of nitre; these proportions afford about one part of orange-coloured nitric acid of the specific gravity of 1.48. Upon the large scale, 112 lbs. of nitre and 56 lbs. of sulphuric acid, yield from 50 to 52 lbs. of nitric acid. Some manufacturers employ three parts of nitre and two of sulphuric acid, and the *London Pharmacopœia* direct equal weights of nitre and sulphuric acid, by which a nearly colourless nitric acid is produced, provided the distillation be conducted at as low a temperature as possible. The distillation of nitric acid may be conducted upon a small scale in a

tubulated glass retort, *a* (see engraving, fig. 1), with a tubulated receiver, *b*, passing into the bottle, *c*. The requisite heat is obtained by the lamp, *d*, and the whole apparatus supported by the brass stands, with sliding rings, *e e*. But the manufacturer who prepares nitric acid upon the large scale, generally employs distillatory vessels of stone ware. Fig. 2 represents the arrangement of the distillatory apparatus employed at Apothecaries' Hall for the production of common *aquafortis*. It consists of an iron pot set in brick-work over a fire-place, an earthen head is luted upon it, communicating with two or more receivers of the same material, furnished with earthenware stopcocks, the last of which has a tube of safety dipping into a basin of water. The nitric acid of commerce, as obtained by the above processes, is always impure, and muriatic and sulphuric acids may usually be detected in it. The former may be separated by nitrate of silver, and the latter by a very dilute solution of nitrate of baryta. To obtain pure nitric acid, therefore, add to that of commerce a solution of nitrate of silver as long as it produces any white precipitate, and when this has subsided, pour off the clear liquor, and add in the same way the nitrate of baryta, then distil the acid, and it will pass over perfectly pure. Nitric acid is a colourless liquid, extremely sour and corrosive, and very intense in its action upon the greater number of inflammable bodies. Its specific gravity, as usually obtained, fluctuates between 1.4 and 1.5. At 40° the concentrated acid congeals; when diluted with half its weight of water, it freezes at about 2° below 0°. Its salts are called *nitrates*.

Nitrous acid may be obtained by mixing two volumes of nitric oxide with one volume of oxygen; much heat is evolved, and the gasses become condensed to one-third their original volume, and form nitrous acid or rather vapour, for it is condensed at 0°. This gas supports the combustion of a taper of phosphorus and of charcoal, but extinguishes sulphur. It is readily absorbed by water, forming a sour liquid. Its specific gravity is as 3.162 to 1.000. It forms salts termed *nitrites*.

Hydrochloric acid may be readily procured by acting upon common salt or sal ammoniac by sulphuric acid: the evolved gas must be collected over mercury. The salt should be put in fragments into a small tubulated retort, which may be one-fourth filled with it; the sulphuric acid should barely cover the pieces of salt; the gas is instantly extricated, and when its evolution slackens, it may be quickened by the gentle heat of a lamp. It is convenient to put a long strip of folded blotting paper into the neck of the retort, which absorbs any liquid which may chance to go over, and prevents its soiling the mercury. Hydrochloric acid gas is perfectly unrespirable; it extinguishes the flame of a taper. Although permanently gaseous at all common temperatures and pressures, Mr. Faraday liquified this gas by generating it in a sealed tube, so as to expose it to a pressure of about forty atmospheres at 50°. It was colourless, and possessed a refractive power inferior to that of water. Hydrochloric acid gas has a strong attraction for water; when it escapes into the air it forms visible fumes, arising from its combination with aerial vapour. A piece of ice let up into the gas over mercury, immediately liquifies it and absorbs it; and if a tall jar of the gas be carefully transferred, with its mouth downwards, from the mercurial to the water-trough, the water instantly rushes in with violence and fills it. Litmus paper is powerfully reddened by this gas. Water takes up 480 times its bulk of muriatic acid gas, and has its specific gravity increased from 1 to 1.210. This may be shown by throwing up a few drops of water into a tall jar of the gas standing over mercury, the gas disappears, and the mercury fills the vessel. There is considerable elevation of temperature during the condensation of the gas. When the liquid acid is pure, it is perfectly colourless, but it generally has a yellow hue, arising from particles of cork or lute that have accidentally fallen into it, or sometimes from a little iron. The acid of commerce almost always contains iron and sulphuric acid, and sometimes nitric acid. The concentrated acid emits fumes; when exposed to the air, it boils at a temperature of 112°, and gives off the gaseous acid; it freezes at 60°. It is decomposed by the chloric, iodic, and bromic acids, and several of the metallic oxides. It forms salts called *hydrochlorates*.

Hydrocyanic or *Prussic acid*, may be obtained by introducing cyanuret of mercury into a tubulated glass retort, and pour upon it rather less than its weight of muriatic acid (specific gravity 1.200). Adapt a horizontal tube to the beak of the retort about two feet long and half an inch in diameter; fill the first third of the tube next the retort with small pieces of white marble, the other two-thirds with fragments of fused chloride of calcium, adapt to its end a small receiver surrounded by a freezing mixture; on applying a gentle heat to the retort, hydrocyanic vapour will pass through the tube, and be-

come condensed in the cold receiver; any portion of muriatic acid and watery vapour that may rise along with it, will be retained by the carbonate and chloride; after this part of the process, the whole length of the tube should be gently heated, to expel the residuary hydrocyanic acid. Another mode of obtaining hydrocyanic acid, is that recommended by Vauquelin; it consists in placing cyanuret of mercury in a tube connected with a cooled receiver; sulphuretted hydrogen is then passed over the cyanuret, the sulphur of which combines with the mercury to form a sulphuret of mercury, and the hydrogen unites to the cyanogen to form hydrocyanic acid, the whole of which may be easily driven off by the application of a gentle heat into a cold receiver, and there condensed. The hydrocyanic acid thus obtained, has a strong pungent odour, very like that of bitter almonds; its taste is acid, and it is highly poisonous, so that the utmost care should be taken to avoid the inhalation of its vapour. It volatilizes so rapidly, as to freeze itself. It reddens litmus. The specific gravity of its vapour compared with hydrogen, is as 13.5 to 1. It consists of 1 volume of cyanogen + 1 volume of hydrogen, forming two volumes of the hydrocyanic vapour. Its salts are termed *hydrocyanates*.

J. Mitchell.

QUERY.

What will be the thickness of metal required for a concave copper ball, eight inches diameter without, so as to sink to its centre in common water?

ANSWER.

$\frac{.2618 \times 8^3}{27.7274} = 4.834$ lbs. weight of the hemisphere of water displaced, which is equal to the weight of the ball required, *w*.

A copper ball five inches in diameter weighs 21 lbs.; hence for any other,

$$5^3 : d^3 :: 21 : w = \frac{21\,d^3}{125} = \frac{d^3}{6} \text{ nearly.}$$

Hence $\frac{D^3 - d^3}{6} = w =$ weight of the shell in lbs. where D is the external and *d* the internal diameter.

$\therefore d = \sqrt[3]{D^3 - 6w} = \sqrt[3]{8^3 - 6 \times 4.834} = \sqrt[3]{483} = 7.845$ internal diameter, which deducted from 8, leaves .155 difference of diameters; half of this = .0775 = rather more than one-thirteenth of an inch for the thickness of the ball.

The same, by the Slide Rule.—To 5.96 of A set 8 of the slide; over 8 of D is 85 lbs., the weight of a solid globe of copper.

To 105.9 of A set 8 of the slide; over 8 of D is 4.83 lbs., the weight of the displaced water.

$$85 - 4.83 = 80.17.$$

To 5.96 of A set 80.17 on the slide inverted; the point where equal values meet is 7.85 & 8—7.85 = 15.

Then $\frac{.15}{2} = .075 = \frac{1}{13}$th of an inch as before.

W. W.

MISCELLANEA.

The First Railroad in Italy.—The railroad from Naples to Castellamare was opened on the 3rd ult. by the King in person. His Majesty, on alighting with the royal family, was received by the Minister of the Interior, a commissioner appointed by the French shareholders of the company, and the chief engineer. M. Dubois, the French commissioner, made a suitable address to his Majesty, to which the King replied, "I have given my entire protection to this the first essay of the kind in Italy, and being convinced of its utility, I contemplate in the termination of your works as far as Nocera and Castella, a continuance of the communication by Avellina to the Atlantic." The King then minutely examined the locomotive engines and other parts of the establishment, and returned to Naples. M. Dubois and M. Bayard, the chief engineers, have been created knights of the order of Merit of Francis the First.—*Morning Paper.*

Chemical Powers of Light.—M. Edmond Becquerel has recently communicated to the Académie des Sciences, some important investigations on the chemical powers of solar light, which will probably lead to new and valuable results. It has been long known that light has the power of variously affecting certain chemical compounds; sometimes causing combination between two elements, and in other cases effecting the decomposition of compound substances; and it has been found that when a pencil of light is decomposed by passing through a prism of glass, those rays which possess this power are differently refracted from the coloured rays, and hence the existence of peculiar rays, to which the name *chemical rays* is given, has been deduced. The chief difficulty in experiments on these rays has been, the slow nature of the actions caused, and the difficulty of appreciating them. M. Becquerel has overcome these sources of uncertainty, and is enabled to study the chemical powers of light with ease, and measure the effects produced, with considerable accuracy. The manner in which this is done is very simple. Two liquids of different densities, but both conductors of electricity, and of such nature as to act chemically upon each other when exposed to the influence of solar light, are selected; and a portion of both is put into a cylindrical vessel blackened on the exterior. A plate of platinum is placed in the denser of the two fluids, and another similar plate is also immersed in the lighter liquid; these plates being then connected by means of platinum wires with the two terminations of a very delicate galvanometer, the apparatus is complete. If when thus arranged a ray of light is suffered to pass through the mass of fluid, it causes chemical action to take place at the surface of contact between the two liquids, and a current of electricity which this sets in circulation is immediately rendered evident by the galvanometer. As the angle of deflection of the galvanometer indicates the power of the electric current, and as this is in exact proportion to the chemical action which originates it, it is evident that this arrangement gives an accurate measure of the power of the chemical rays of light, at different times, from different sources, and under various circumstances. M. Becquerel details some experiments on the quantity of these chemical rays, which is intercepted when a ray of light is made to pass through screens of different substances, such as rock crystal, mica, and variously-coloured glasses; and states that he is still engaged in experimenting on the subject.—*Athenæum.*

A Short Name.—The Dutch journals announce that King William has invested the Sultan of Djocjokata, with the dignity of commander of the order of the Lion of the Netherlands; the Sultan's name is

Hamankoeboewonosenopatiingalogongabgurrachmansaydinpmnotogonoole, the Fifth.

To make Oats doubly Nutritious.—Instead of grinding the oats, break them in a mill, and the same quantity will be doubly nutritious. Another method is, to boil the corn and give it to the horses with the liquor in which it has been boiled; the result will be, that instead of six bushels in a crude state, three bushels so prepared will be found to answer, and to keep the animals in superior vigour and condition.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Nov. 13, A. J. Mason, Esq., Sketches of the United States, Geographical, Political, and Moral. Friday, Nov. 15, B. R. Haydon, on the History of Art, from the earliest time. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 14, H. W. Woelrych, Esq., on Education. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Nov. 15, Mr. Joshua Crockform, on the Application of the Force of Gravity. At half-past eight.

QUERIES.

How to make blue ink that will not change its colour? V. T. Z.

What will turn brass to a steel or any dark colour, so that it will polish the same as any other metal? C—s C—s.

TO CORRESPONDENTS.

Alpha.—*The experiments of M. Despretz concerning the transmission of heat in liquids, were minutely described in a recent number of the "Mechanic."*

Gulphy *wishes to know which are the best works on boxing, wrestling, and fencing: for the first, we should say that the best books are those which condemn the practice in the strongest terms of reprobation; as for fencing, it may be well enough between a butcher and a pig or a sheep, and perhaps necessary for some military men; but those who persuade youth that sticking or shooting one another is honourable, merit the abhorrence of all good and sensible men. Scratching and biting may be considered as honour amongst the grey rats of Montfaucon, or the toads and water lizards in a horse pond; but it is not so between men; a generous heart and a spotless mind, that is true honour; and let those who pretend that honour is derived from the mutilation of their fellow-creatures, be consistent, and bow down with reverence to the Tom Cat, who, according to the principles which they propound, must be more honourable than any two-legged gentlemen upon earth.*

J. Mitchell *is requested to oblige "Juvenile Entertainer" with his address, that gentleman having some chemical discovery to communicate.*

W. P. *and* E. P. *shall be answered in our next.*

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THE

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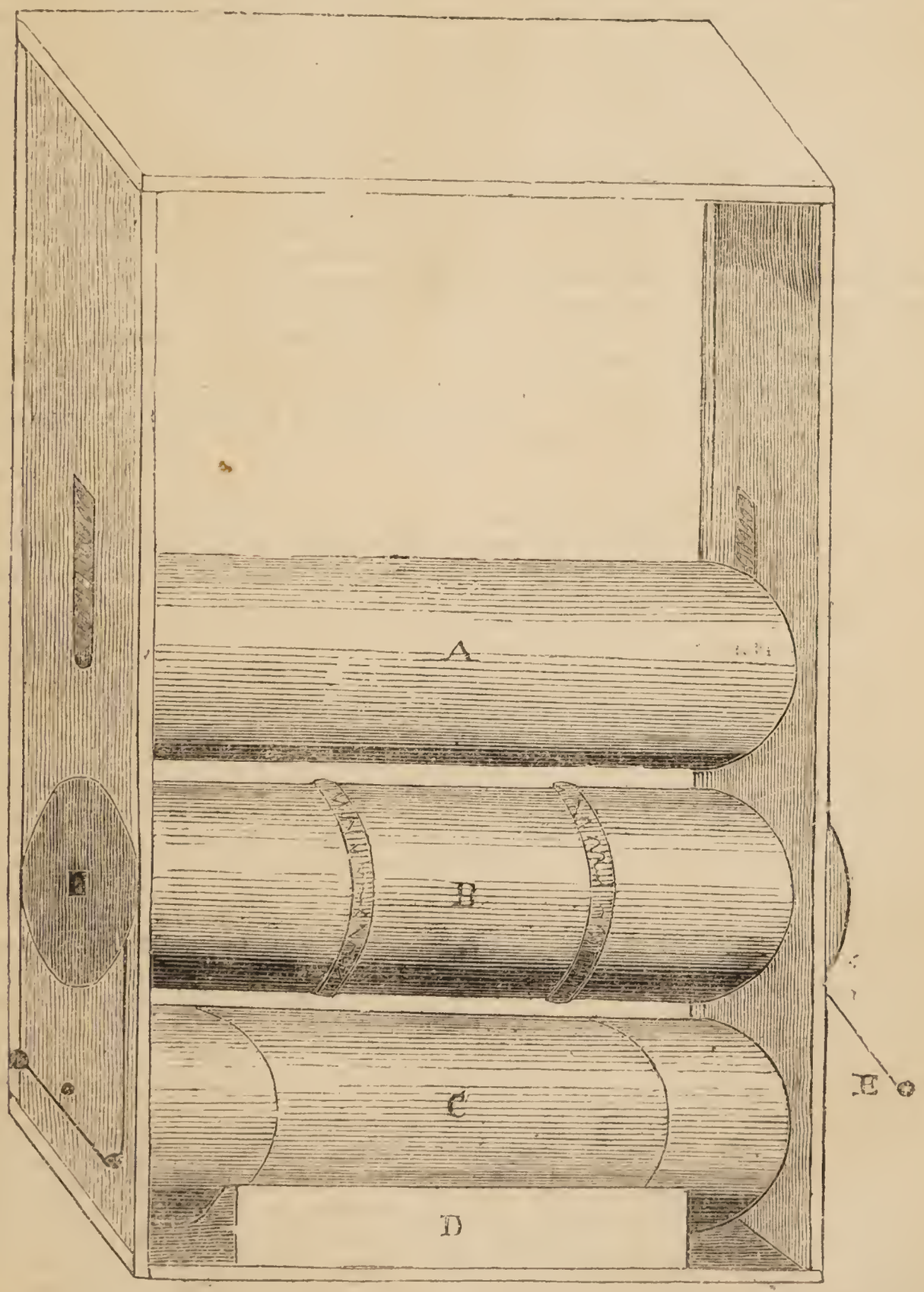
A MAGAZINE OF THE ARTS AND SCIENCES.

No. 61, NEW SERIES. } SATURDAY, NOV. 16, 1839. PRICE ONE PENNY. { No. 182, OLD SERIES.

SCOTT'S MACHINE FOR STAMPING LETTERS.



VOL. V.—No. 12. City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney

PENNY POSTAGE.

(See Engraving, front page.)

[*No letter to be carried which is not written on stamped paper.*]

The paper to be stamped in the making, under the superintendence of the Excise, and a price set upon the said paper, sufficient to remmunerate government for the carriage and delivery of the same, in the form of letters. The amount paid for stamping to be charged on the usual price of such paper by the manufacturer to the retailer, and by the retailer to the consumer. The object to be attained in this, being, that whilst it removes all cause for complaint of monopoly on the part of the manufacturer, brings the amount of the carriage of such letters through a more direct channel, than by the said amount being brought in by the deliverers of such letters; at the same time, saving a great sum of money, which would otherwise be expended for labour, and which would necessarily be incurred by the additional number of letters arising from the reduced postage. The deliverer, not having to receive postage for the letters he carries out for delivery, would, of course, be enabled to deliver *a considerable number more*, and that in *less time*.

Letters weighing no more than is allowed at the present time for single letters, to be carried as single letters; whilst those letters which are above the weight of a single letter, and not exceeding double such weight, to be charged *one penny extra*, either at the time of posting, or on the delivery of the said letters. Above this double weight, and up to a certain weight to be fixed by government, *twopence extra charge*, above which weight no letters should be carried.

The *stamp* for the paper, on which all letters to be sent by post must be written, I would propose to be that of the *royal arms*; the impression of which to be made on the opposite side of the paper to that on which a letter is commonly commenced; so that on folding the letter, the impression of the royal arms may be outside, and the address to be written over it.

Another proposition I would make, and which, I presume, would tend materially to the furtherance of the object now under consideration, is the manner of constructing the letter-boxes at the several receiving-houses under the operation of the penny post. The additional number of letters arising from the reduction of the postage, will not only require additional time for the stamping of such letters with the district mark, but will, in many instances, cause numerous mistakes and even delay. To remedy this inconvenience, I propose the letter-boxes to be thus constructed.

Description of Letter-box.

I propose that there should be fixed inside the letter-box, close to the mouth, three rollers (see engraving, A B C); these rollers are for the purpose of stamping the letters as they are put in; D is a box containing ink; the roller, C, which is to be covered with cloth for imbibing the ink, revolving in the box, will ink the type or stamp on the roller, B; so that, if the end of a letter be introduced between the rollers A and B, and the roller be set in motion, the letter must necessarily be drawn into the box, and be stamped at the same time: motion to be given to the roller by the pull at E; and after the letter has passed into the box, the spring, I, brings the rollers back into their former position, ready for another letter. Thus, every person stamps his own letters, which precludes all possibility of detention. Stamp 1, is the district mark; stamp 2, the date and time. As the type of the date stamp will require frequent altering; figures may easily be furnished with screws for receiving them on the roller.

W. Scott.

INVENTION OF GUNPOWDER.

Next to the invention of printing, there is no other that so much arrests our attention as that of gunpowder, which, by introducing artillery, and a new method of fortifying, attacking, and defending cities, wrought a complete change in the whole art and tactics of war. This invention comprises several discoveries, which it is necessary to distinguish from each other. 1. The discovery of nitre, the principal ingredient in gunpowder, and the cause of its detonation. 2. The mixture of nitre with sulphur and charcoal, which, properly speaking, forms the invention of gunpowder. 3. The application of powder to fire-works. 4. Its employment as an agent or propelling power for throwing stones, bullets, or other heavy and combustible bodies. 5. Its employment in springing mines and destroying fortifications.

All these discoveries belong to different epochs. The knowledge of saltpetre or nitre, and its explosive properties, called detonation, is very ancient. Most probably it was brought to us from the east (India or China), where saltpetre is found in a natural state of preparation. It is not less probable that the nations of the east were acquainted with the compo-

sition of gunpowder before the Europeans, and that it was the Arabs who first introduced the use of it into Europe. The celebrated Roger Bacon, an English monk or friar of the thirteenth century, was acquainted with the composition of gunpowder, and its employment in fireworks and public festivities; and according to all appearances, he obtained his information from the Arabic authors, who excelled in their skill of the chemical sciences. The employment of gunpowder in Europe as an agent for throwing balls and stones, is ascertained to have been about the commencement of the fourteenth century; and it was the Arabs who first availed themselves of its advantages in their wars against the Spaniards. From Spain, the use of gunpowder and artillery passed to France, and thence it gradually extended over the other states of Europe. As to the application of gunpowder to mines and the destruction of fortified works, it does not appear to have been in practice before the end of the fifteenth century. The introduction of bombs and mortars seems to have been of an earlier date (1467). The invention of these in Europe is attributed to Sigismund Pandolph Malatesta, Prince of Rimini; but in France they were not in use till about the reign of Louis the Thirteenth. Muskets and matchlocks began to be introduced early in the fifteenth century. They were without spring-locks till 1517, when for the first time muskets and pistols with spring-locks were manufactured at Nuremberg.

Several circumstances tended to check the progress of fire-arms and the improvement of artillery. Custom made most people prefer their ancient engines of war; the construction of cannon was but imperfect; the manufacture of gunpowder bad; and there was a very general aversion to the newly-invented arms, as contrary to humanity, and calculated to extinguish military bravery. Above all, the knights, whose science was rendered completely useless by the introduction of fire-arms, set themselves with all their might to oppose this invention.

From what we have just said, it is obvious that the common tradition, which ascribes the invention of gunpowder to a certain monk named Berthold Schwartz, merits no credit whatever. This tradition is founded on mere hearsay; and no writers agree as to the name, the country, or the circumstances of this pretended inventor, nor as to the time and place when he made this extraordinary discovery.—*Koch's Revolutions of Europe.*

EMIGRATION TO THE WEST.

"ENGLAND, with all thy faults I love thee still," is a sentiment which recollection has often whispered to the emigrant in the bitterness of his disappointed hopes; and an intimate knowledge of other countries generally tends to make the impression indelible. The following sketches of society in western America, a fertile region, rapidly immerging into civilization, are from "A New Home—Who'll Follow? or, Glimpses of Western Life," by Mrs. Clavers, an actual settler:—

"*Helps in Michigan.*—Some of my dear theorizing friends in the civilized world had dissuaded me most earnestly from bringing a maid with me.

"'She would always be discontented and anxious to return; and you'll find plenty of good farmers' daughters ready to live with you for the sake of earning a little money.'

"Good souls! how little did they know of Michigan. I have since that day seen the interior of many a wretched dwelling, with almost literally nothing in it but a bed, a chest, and a table; children ragged to the last degree, and potatoes the only fare; but never yet saw I one where the daughter was willing to own herself obliged to live out at service. She would 'hire out' long enough to buy some article of dress perhaps, or 'because our folks have been sick, and want a little money to pay the doctor,' or for some such special reason; but never as a regular calling, or with an acknowledgment of inferior station.

"This state of things appalled me at first; but I have learned a better philosophy since. I find no difficulty now in getting such aid as I require, and but little in retaining it as long as I wish, though there is always a desire of making an occasional display of independence. Since living with one for wages is considered by common consent a favour, I take it as a favour; and this point once conceded, all goes well. Perhaps I have been peculiarly fortunate; but certainly, with one or two exceptions, I have little or nothing to complain of on this essential point of domestic comfort.

"To be sure, I had one damsel who crammed herself almost to suffocation with sweetmeats and other things which she esteemed very nice; and ate up her own pies and cake, to the exclusion of those for whom they were intended; who would put her head in at a door, with—'*Miss* (the Michigan word for *Mrs.*) Clavers, did you holler? I thought I *heered* a yell.'

"And another, who was highly offended because room was not made for her at table with guests from the city, and that her company was not requested for tea-visits. And this latter high-born damsel sent in from the kitchen a circumstantial account *in writing*, of the instances wherein she considered herself aggrieved; well written it was too, and expressed with much *naiveté*, and abundant respect. I answered it in the way which 'turneth away wrath.' Yet it was not long before this fiery spirit was aroused again, and I was forced to part with my country belle.

"*Popular Table Habits in Michigan.*—When Angeline left me, which she did after a few days, I was obliged to employ Mrs. Jennings to 'chore round,' to borrow her own expression; and as Mr. Clavers was absent much of the time, I had the full enjoyment of her delectable society, with that of her husband and two children, who often came to meals very sociably, and made themselves at home with small urgency on my part. The good lady's habits required strong green tea at least three times a-day; and between these three times she drank the remains of the tea from the spout of the teapot, saying, 'it tasted better so.' 'If she had'nt it,' she said, 'she had the 'steries so that she wasn't able to do a chore.' And her habits were equally imperious in the matter of dipping with her own spoon or knife into every dish on the table. She would have made out nobly on kibaubs, for even that unwieldy morsel, a boiled ham, she grasped by the hock and cut off in mouthfuls with her knife, declining all aid from the carver, and saying coolly that she made out very well. It was in vain one offered her anything, she replied invariably with a dignified nod, 'I'll help myself, I thank ye. I never want no waitin' on.' And this reply is the universal one on such occasions, as I have since had vexatious occasion to observe.

"Let no one read with an incredulous shake of the head, but rather let my sketch of these peculiar habits of my neighbours be considered as a mere beginning, a shadow of what might be told. I might

> "Amaze indeed
> The very faculty of eyes and ears,'

but I forbear.

"If 'grandeur bear with a disdainful smile'—thinking it would be far better to starve than to eat under such circumstances, I can only say such was not my hungry view of the case, and that I often found rather amusing exercise for my ingenuity in contriving excuses and plans to get the old lady to enjoy her meals alone. To have offered her outright a separate table, though the board might groan with all the delicacies of the city, would have been to secure myself the unenviable privilege of doing my own 'chores,' at least till I could procure a 'help' from some distance beyond the reach of my friend Mrs. Jennings' tongue."

However desirable it may be to cultivate a friendly intercourse between neighbours in a country so thinly peopled as the back states of America, indiscreet familiarity may become a source of considerable annoyance and inconvenience, as appears by the following characteristic sketch:—

"'Mother wants your sifter; and she guesses you can let her have some sugar and tea, 'cause you've got plenty.'

"This excellent reason. 'cause you've got plenty,' is conclusive as to sharing with your neighbours. Whoever comes into Michigan with nothing, will be sure to better his condition; but woe to him that brings with him anything like an appearance of abundance, whether of money or mere household conveniences. To have them, and not be willing to share them in some sort with the whole community, is an unpardonable crime. You must lend your best horse to *qui que ce soit*, to go ten miles over hill and marsh, in the darkest night, for a doctor; or your team to travel twenty after a 'gal;' your wheel-barrows, your shovels, your utensils of all sorts, belong, not to yourself, but to the public, who do not think it necessary even to *ask* a loan, but to take it for granted. The two saddles and bridles of Montacute spend most of their time travelling from house to house a-manback; and I have actually known a stray martingale to be traced to four dwellings two miles apart, having been lent from one to another, without a word to the original proprietor, who sat waiting, not very patiently, to commence a journey.

"But the cream of the joke lies in the manner of the thing. It is so straightforward and honest, none of your hypocritical civility and servile gratitude. Your true republican, when he finds that you possess anything which would contribute to his convenience, walks in with 'Are you going to use your horses *o-day?*' If horses happen to be the thing he needs.

"'Yes, I shall probably want them.'

"'Oh, well; if you want 'em——I was thinking to get 'em to go up north a piece.'

"Or perhaps the desired article comes within the female department.

"'Mother wants to get some butter;

that 'ere butter you bought of Miss Barton this mornin.'

"And away goes your golden store, to be repaid perhaps with some cheesy, greasy stuff, brought in a dirty pail, with 'Here's your butter.'

"A girl came in to borrow a 'wash-dish,' 'because we've got company.' Presently she came back: 'Mother says you've forgot to send a towel.'

"'The pen and ink and a sheet o' paper and a wafer,' is no unusual request; and when the pen is returned, you are generally informed that you sent 'an awful bad pen.'"

The following extracts show that men of talent and good company may be found by those who seek for it, even in this sequestered wilderness:—

"*The Michigan Doctor.*—A physician was sent for, and we expected of course some village Galen, who knew just enough to bleed and blister for all mortal ills. No such thing. A man of first-rate education, who had walked European hospitals, and who had mother-wit in abundance, to enable him to profit by his advantages! It is surprising how many such people one meets in Michigan. Some, indeed, we have been led to suppose, from some traits in their American history, might have 'left their country for their country's good;' others appear to have forsaken the old world, either in consequence of some temporary disgust, or through romantic notions of the liberty to be enjoyed in this favoured land. I can at this moment call to mind several among our ten-mile neighbours, who can boast university honours, either European or American, and who are reading men even now. Yet one might pass any one of these gentlemen in the road without distinguishing between him and the Corydon who curries his horses, so complete is their outward tranformation."

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 62.)

THERE is a legend connected with Buckingham, which shows the unbounded credulity and superstition which prevailed in the "good old times" of the middle age; it is the history of one St. Rumbald, who lived only three days, during which period he professed himself a Christian, and performed miracles; he was born at King's Sutton, where his body rested for one year, after which it was kept two years at Brackley, and then deposited in the church at Buckingham, there to remain for ever, according to the tenor of his will. This story was so "incredibly attested," that it became a source of considerable profit to the town, by attracting numerous pilgrims, who made offerings at his shrine. *Stowe*, the magnificent seat of the Duke of Buckingham, is situated about two miles from the town of Buckingham; when viewed from a distance, it presents the appearance of a vast grove, from which arise the summits of elegant towers, columns, obelisks, and temples. The grounds are very extensive, and although they have been celebrated for ages past amongst the finest specimens of ornamental gardens in this country, they have been greatly improved by the more refined taste of modern times. It was formerly the fashion to imitate the French in their formal stiffness, which made the plan of a garden appear more like a geometrical diagram, than an exhibition of the beauties of nature. The frequent and friendly communications which, during twenty-four years' peace, have existed between the two countries, have now, in some degree, corrected this vicious taste; they occasionally allow nature to display her beauties unoppressed by the tyranny of art, and unmutilated by the pruner's knife; such gardens they term *jardins à l Anglaise*. The love of pruning and cropping, is a striking characteristic of the French nation; they are not satisfied with frightfully disfiguring the hedges and trees in their gardens, but the heads of their most revered functionaries, and the hind quarters of their dogs are periodically submitted to the same humiliating operation of cropping. Even the words they borrow from foreign languages, are clipped, spoiled, and "curtailed of their fair proportions"; *gloria*, they reduce to *gloire*, and pronounce it *glwor*; *Navarino* is pinched into *Navarin*, which they pronounce with an indescribably unpleasant articulation, something resembling the sound produced by holding one's nose, and endeavouring to pronounce the word *Ann*—in fact, the only good that ever resulted from this cropping propensity, is the abolition of pig-tails. But things are altered now; in this country, at least, trees are no longer cut into pyramids and prisms, nor shrubs into squares and oblongs; nature is cultivated, but not disguised; secure from gallic shears, the privit unfolds its white blossoms, the bright passion flower reclines in Paradisean peace on the tender foliage of the fragrant jessamine, and the luxuriant vine curls with joy as it creeps through the cool branches of the pale tilia.

OF THE VALUE OF IRON,

AND THE NECESSITY OF ITS PRESENCE TO THE ADVANCEMENT OF CIVILIZATION.

Iron is one of the most useful metals with which man is acquainted, though not, perhaps, so valuable as some, when taken in equal proportions, yet when taken as a metal generally, is of much greater value than gold,—for the value of metal is according to the quantity procured, and of that disposed of.

We are liable to take up a nail or any other piece of iron, and throw it aside with the utmost disdain, but for one instant suppose, that iron ceased to be procured, you would then see, that every scrap of iron, whether nail, hoop, or of any other kind, would be sought after with the utmost eagerness. Or, in plainer terms, that all machinery, boilers, bridges, &c., were taken away, then what would society become? It would gradually sink into a state of demi-barbarism, you would then see the splendid edifices that are constantly being raised, fall to premature decay for the want of the first necessary tools; for the stone cannot be cut from the quarry without tools – cannot be fashioned without tools—cannot be raised to an eminence without tools—in all of which you will find iron more or less necessary.

Again, suppose that gold ceased to be found, or that gold was abstracted suddenly from society, how different would be the result; they could quickly find a substitute in silver, copper, zinc, or any other metal, which would, by affixing the stamp belonging to the sovereign, answer the purposes of commerce equally as well as gold. Or perhaps a better substitute might be found in paper, with which substitute I have nothing to do, my object being to show that iron, by its answering so many useful purposes, by being, in fact, an indispensable necessary, is not a metal to be regarded as insignificant, because it is common; for, as a clever man once observed, "*everything that is good, is common.*" Thus you see persons that are not in the habit of thinking, regard iron as almost superfluous, and gold as not only necessary, but above all price.

A little thinking on the subject will, however, soon convince any rational person, that to abstract iron from society, is to abstract civilization; but, on the other hand, to abstract gold, is only to form a vacuum that may easily be filled up.

W. J. Cuthbert.

[We cannot agree with our correspondent's "clever friend," that everything thing that is good is common." Gold is intrinsically a very good thing; and if we once possessed it in abundance, its "abstraction," and the necessity of supplying its place with corroding and poisonous metals, would be deemed a heavy blow upon humanity; good Burgundy, pines, and turtle, are things of unimpeachable goodness, but none of them very common—at least in this city, where they are most esteemed. True friendship, disinterested charity, and even the negative virtue of inert honesty, are all good things, and it is much to be lamented that they are not more "common." In fact, so far from vulgar error overrating the properties of gold, its real value is not generally appreciated; while the utility and importance of iron, are universally acknowledged, but many, like our correspondent, imagine that the discovery is their own, and that others do not entertain the same opinion. —Ed.]

THE CHEMIST.

ACIDS.

No. VII.

Indigotic Acid.—To obtain it, nitric acid of specific gravity 1.285 must be diluted with rather more than its weight of water heated in a retort, and small portions of indigo in fine powder added, as long as sensible effervescence is produced, and a little water is added from time to time, to prevent the formation of carbazotic acid. The yellow liquid is separated whilst hot from the resinous matter, and by cooling, deposits crystals of the acid of indigo. This is boiled with oxide of lead filtered, and the salt present decomposed by sulphuric acid whilst hot; on cooling, it deposits yellowish white crystals of indigotic acid; these are to be separated, dissolved in hot water, neutralized by carbonate of baryta, the solution concentrated, and allowed to cool; yellow acicular crystals of a barytic salt are obtained, which, being washed with cold water, dissolved in hot water, and decomposed by sulphuric acid, give acicular crystals of indigotic acid quite pure. This acid is white, having the lustre of silk; it has a weak, acid, bitter taste, reddens litmus, dissolves in any quantity in boiling water and alcohol, forming colourless solutions, but requires 1000 parts of cold water for its solution. It is volatile, and being heated in a tube, fuses and sublimes without decomposition. In the air it burns with a bright flame, evolving much smoke. Nitric acid con-

verts it to carbuzotic acid. It gives a blood-red colour to solutions of the persalts of iron. It has the power to expel carbonic acid from carbonates. Its combinations with bases form salts called *indigotates*.

Laccic Acid.—To obtain it, the gum lac is digested in water, the solution evaporated, and the residue digested in alcohol. The alcoholic solution is evaporated to dryness, and its residue digested in ether. The evaporation of the etheric solution leaves a yellow matter, which being again dissolved in alcohol, and the solution mixed with water, deposits a little resin, and leaves laccic in solution, which, upon the addition of acetate of lead, gives a precipitate of laccate of lead; the latter compound, by cautious decomposition by sulphuric acid, affords laccic acid. It is crystallizable, of a yellow colour, a sour taste, soluble in water, alcohol, and ether. Its salts are termed *laccates*.

Lithic, or *uric acid*, may be abundantly obtained, by digesting urinary calculi in caustic potassa, filtering the solution, and adding hydrochloric acid in excess, which causes a precipitate of lithic acid, which may be washed with warm water and dried. Lithic, or uric, thus obtained, is a grey powder, of scarcely any taste, and requiring, according to Dr. Henry, 1720 parts of water at 60°, and 1150 parts at 212° for solution. It reddens infusion of litmus. Its salts are called *urates* or *lithates*.

Malic acid was obtained by Scheele from the juice of apples in 1785. He obtained it by adding a solution of acetate of lead to the expressed juice of unripe apples, by which *malate of lead* was formed, and afterwards decomposed by sulphuric acid. It may also be obtained from the berries of the mountain ash as follows:—Express the juice of the ripe berries, and add a solution of acetate of lead; filter and wash the precipitate with cold water, then pour boiling water upon the filter, and allow it to pass through the precipitate into glass jars; after some hours, crystals are deposited, which are to be boiled with two-thirds their weight of sulphuric acid, specific gravity 1.090. The clear liquid is to be poured off, and while hot, a stream of sulphuretted hydrogen is to be passed through it to precipitate the remaining lead, the liquid is then filtered and boiled, so as to expel the sulphuretted hydrogen in a solution of the pure malic acid. When carefully prepared, it is a colourless liquid, very sour, and not susceptible of a regular crystallization, though when very carefully evaporated, it concretes into mammillary masses, showing traces of acicular crytsals. Nitric acid converts it into oxalic acid. Its salts are termed *malates*.

MISCELLANEA.

To produce Homogeneous Light.—An experiment, productive of much amusement, and at the same time illustrating the cause of colours, may be performed with homogeneous light. If a little spirits of wine, or some spirit, such as gin, be ignited in a dish, and a quantity of common table salt thrown on it, the lights in the room having been previously put out, every person present will assume an extraordinary colour; the hue of health will disappear from the cheeks, and the different articles of clothing will entirely change their colour. The cause of this phenomenon will be found in the circumstance, that the colour of bodies depends upon the rays of light being partly absorbed, and partly reflected. A ray of light can be shown to consist of seven prismatic colours, and different bodies possess the power of absorbing one or more of these colours, and reflecting all the rest; and the combination of the rays that are reflected, gives the particular colour to an object. Red-coloured bodies absorb all the rays, *except the red ray*; and this accordingly appears to be the colour of the body, and so on of all other colours. When homogeneous light is produced by the means above mentioned, as the articles of dress, and the faces of the company do not absorb all the yellow rays, but reflect a portion, the colour of everything is changed.—*Dalton's Book of Experiments.*

Porosity of Cotton.—Fill a common glass tumbler, or other vessel, completely with some spirituous liquor, so that a few drops more would cause it to overflow. This done, you would find no difficulty in introducing into the tumbler, so filled, a whole handful of raw cotton. Spirits answer better than water, for trying the experiment, from the rapidity with which they are absorbed by the cotton. Several theories were started by persons who tried the experiment; such as, that the filaments of cotton occupied the vacancies between the globules of water; or that by its capillary action the cotton subdivided the globules, and caused them to occupy a less space, &c.; to me, however, it appears to be accounted for more satisfactorily, by supposing the fluid to insinuate itself between the filaments of cotton, and thus permit the latter to occupy no more space than is due to their actual solidity.—*Journal of Franklin Institute.*

The Royal Exchange.—The New Royal Exchange, a place of congregation for merchants of the whole civilized world, in the first commercial city of ancient or modern times, a structure that will challenge criticism more frequently than any other in the metropolis, ought to be an object of the first importance. Expense, though an element in the question, should be a consideration subordinate to that which involves the taste of the country. The cost of a New Royal Exchange should not be stinted, like that of a gold or silver canister for the freedom of the city. A

grand building would be worth any money; a bad or inferior one may be worth nothing at all, or less than nothing. Of the eight designs selected by the three professional judges, No. 50, the best, and apparently so deemed by the judges, is set aside, because it is supposed that it will exceed 150,000*l*., the sum to which the cost of the edifice is restricted; and consequently a design is to be selected from an inferior class. We are told that No. 50 might be erected for that sum; but if the contrary, surely it would be better to open a public subscription, in order to cover the excess, which, we are persuaded, would be speedily filled. The question which the judges should have had to determine, is simply which of the designs is decidedly the best? The rejection of a good plan for such a building, because it would cost a few thousands more than a bad one, will expose us justly to the contempt and scorn of other nations.—*Old England.*

A Cure for Rheumatism.—Rub dry flour of mustard upon the part affected, holding the part at the same time before a fire. Give it a good rubbing for some time, sufficient to bring out a rash on the skin, and relieve the pain. One rubbing is generally found sufficient. This is a Scotch old woman's recipe for rheumatism, and seldom fails in effecting a complete and very speedy cure.

Artificial Memory.—A humorous comment on such systems was made by a waiter at an hotel where Feinaigle dined, after having given his lecture on artificial memory. A few minutes after the professor left the table, the waiter entered with uplifted hands and eyes, exclaiming, "Well, I protest the memory man has forgotten his umbrella."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery lane. Wednesday, Nov. 20, A. J. Mason, Esq., Sketches of the United States, Geographical, Political, and Moral. Friday, Nov. 22, B. R. Haydon, on the Muscles of the Lower Extremities; illustrated by the Living Model. At half-past eight precisely.

Westminster Literary and Scientific Institution 6 and 7, Great Smith-street. Thursday, Nov. 21, H. W. Woolrych, Esq., on Provident Societies. At half past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Nov. 22, Dr. N. Rogers, on the Mythology of the Ancients. At half past eight.

QUERIES.

A "Subscriber from the Commencement" would feel greatly obliged if "Proportio," or any of your scientific correspondents would give a series of papers on the architecture of bridges. Also, from what substance the splendid light, commonly called the Bude light, is obtained, and its claims to general adoption in superseding gas. Likewise, a description of the mechanical contrivance by which the tolls are checked on Waterloo and other bridges.

Where can I obtain a book which contains the best instructions for carving and gilding? also upholstery work? I mean the cutting out of drapery. The best and most simple work on perspective drawing? A. C. R.

If there should be one amongst your numerous readers who has a magic lantern to dispose of, I should be glad if he would state size and price? I do not wish to have one larger than will admit sliders of four inches. A receipt to make French polish? GUILELMUS.

Where can I obtain a copy of Dr. Arnott's Elements of Physics? Perhaps some one of your readers has a copy to dispose of.

J. P. D.

TO CORRESPONDENTS.

W. P.—*The cause of grape shot spreading when fired from a cannon, is their being so much smaller than the bore of the cannon, that they are not guided in a straight line, being projected in various directions according to their position and the surface which receives the impulse. His second query may be answered by similar reasoning.*

E. P.—*Ventriloquism signifies an internal speaking, that is, an articulation without perceptible motion of the lips; it is no more to be acquired, than the fine tones of a singer, and depends upon a peculiarity of conformation in the organs and command of their action, which science has not hitherto been able to explain.*

Gulielmus *shall be answered in our next.*

W. J. Cuthbert.—"*Quot homines, tot sententiæ*"—*by obliging him (which we should be happy to were it in our power) we should displease a great number of our readers; our correspondent not only prescribes the particular subjects which are to occupy the columns of the "Mechanic," but he complains of our not anticipating the objects of his predilection. He says "you had very lately an extract headed 'Hints on Health,' which in my humble estimation was not apropos; for let me ask, what do I, as a student in chemistry, want to know about hints on health, or a respected friend of mine, a clever student in mechanics, care about health?' This requires no comment; we thank him for his intentions, which we presume to be good; and regret that we cannot, with propriety, comply with his desire, by confining this work to the specialities which he proposes.*

S. Walter's *communication has been unavoidably delayed, but shall appear, if possible, next week.*

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THE

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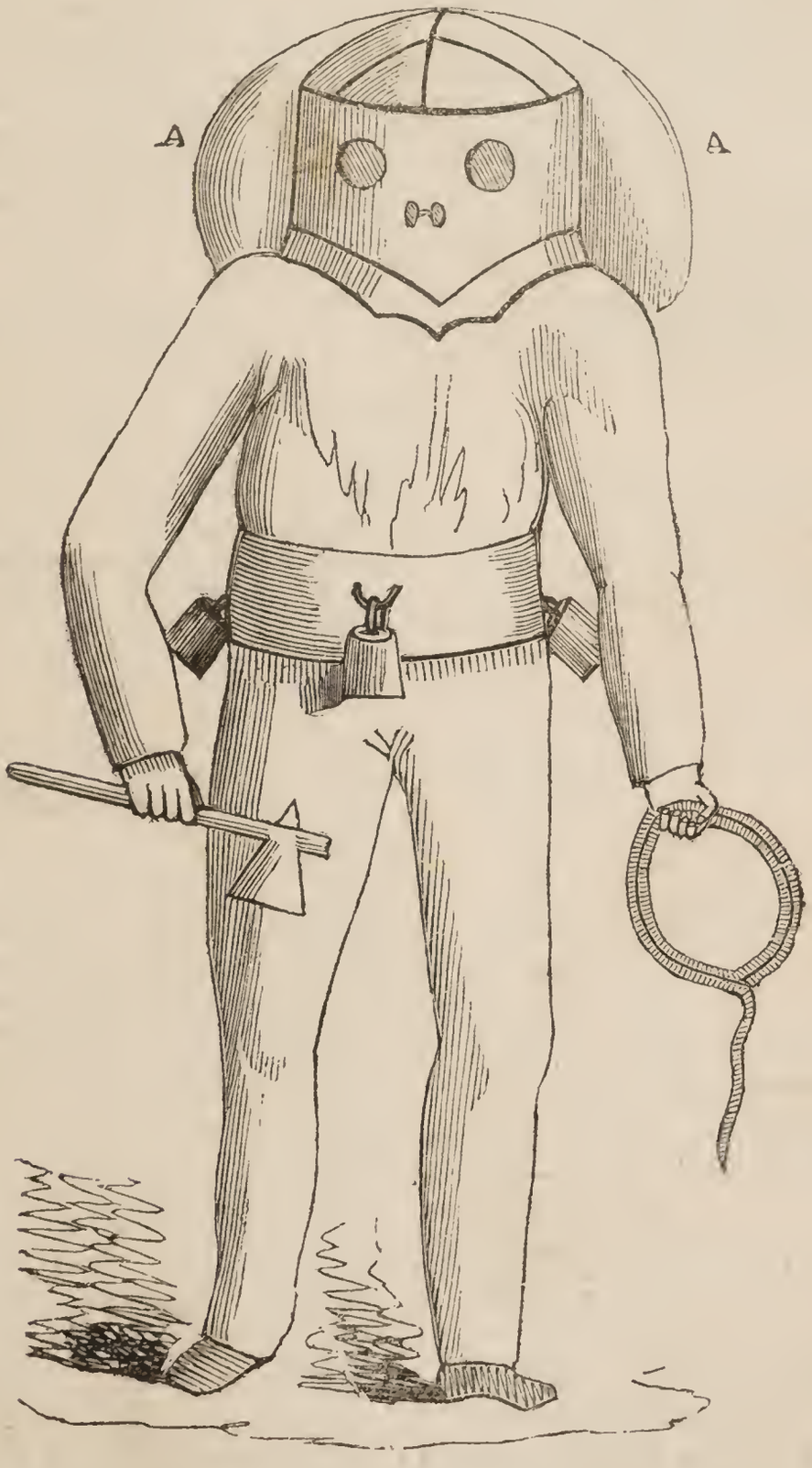
PIESSE'S APPARATUS FOR REMAINING UNDER WATER.



VOL. V.—No. 12.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PIESSE'S APPARATUS FOR REMAINING UNDER WATER.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir.—I herewith send you a drawing of an apparatus for remaining under water a short time, without having any communication from above. The apparatus is the same as usual, with this exception, the individual is supplied with air from a copper bag at his back, which contains condensed air. The mode of supplying the diver with a continued stream of air, and for it to enter the helmet at the same velocity throughout the time he is under water, I do not think proper to give the public, without some slight remuneration from some person or other, although, Mr. Editor, I would give it to *you* with pleasure, as I think it an honour due to you from all individuals occupying your valuable pages. The bag, as I term it, can be made to hold about twenty gallons under pressure; and as we require about one gallon every minute, I should be able to remain under water a quarter of an hour with ease. The admixture of one-thirtieth more of oxygen with the air would, I think, counteract the effect of the cold experienced by persons in this situation, as it would cause the circulation to be carried on rather faster. The benefit derived from this apparatus over the old one is, 1st, its comparative cheapness, there being nothing more required to condense the air than a common piston of a condensing pump; 2nd, its use to the Humane Society for a man to wear when in search for a body, instead of drags, which prove very often useless; 3rd, there are many lakes, canals, &c., with treasures at their bottoms, which might be recovered by this means, and at so trifling an expense; only one man being required, and no pumps or any other apparatus whatsoever; 4th, its being able to be used in very quick time, &c., &c.

I am, Sir, yours truly.

Juvenile Entertainer.

241, Oxford-street.

MR. HILL'S REPORT ON THE FRENCH POSTAGE.

This document, as might be expected, contains little information applicable to the new system of postage *promised* in this country; there are, however, some passages which will be read with interest.

"The following is a comparative statement of the receipts and expenditure of the British and French Post-offices for the years 1821 and 1837:—

British Office.

	Gross Receipts, exclusive of Returns.	Expenditure.	Per Centage.	Net Receipts.
Year.	£	£	£	£
1821	2,038,706	645,241	30	1,393,465
1837	2,339,738	669,940	27	1,669,798
Increase	310,032	24,699		276,333

French Office.

Year.	£	£	£	£
1821	955,708	474,162	50	481,246
1837	1,615,294	847,348	52	767,946
Increase	659,586	372,886		286,700

There appears to have been no material change in the rates of charge in either country during the period in question.

From these statements it appears, that the gross Post-office revenue of France is about two-thirds of that of England; the

expenses about 20 per cent more, and the net revenue nearly one-half. But in comparing the expenses, it will be necessary to bear in mind the greater extent of France, and the fact that the expenses for that country include the whole cost of the mail-coaches. On the other hand, the cheapness of labour in France, as compared with England, must also be recollected. A large portion of the increase, both in the receipts and the expenditure of the French Post-office, is owing to the establishment of the 'Poste Rural,' which took place in 1836."

"*Sorting.*—In consequence of the large number of post-towns on some of the roads (the Toulouse road, for instance, has 223), the outward letters are for the most part sorted thrice; namely, first for roads; secondly, for portions of the road (called first side, second side, &c., according to the situation of the boxes in the sorting rooms); and, thirdly, for towns. (With us, the intermediate sorting for 'sides' is unnecessary). In this process, however, much time is saved, by selecting in an early stage of the business all the letters for certain large towns, as is done in the London office also.

In Paris the letters, as they are assorted, are thrown into boxes; in London they are placed on a table so as to keep them 'faced,' that is arranged with the addresses uppermost, with a view to facilitate the after operations; in each office the sorters consider their own plan the best.

As respects the sorting of inward letters, there are some peculiarities in the practice of the Paris office. The letters from the departments, those of the Banlieue, and those of the Petite Poste, are first sorted for districts (nine in number), in three distinct offices. They are then all carried into the letter-carriers' offices, and the letters for each district are thrown on a separate table, round which the letter carriers of the district (generally about twenty in number) are seated, each having before him a portion of the table, divided off by a low partition, a space for the unassorted letters being left in the middle. Each man takes a handful of letters from the heap in the middle of the table, and deals them out like a pack of cards, throwing those which belong to his own walk into his own compartment of the table, and the remainder into those compartments to which they respectively belong. As about twenty men are thus employed at the same time, and at the same table, the letters cross one another in all directions, producing a very curious appearance. The process was gone through with great rapidity, and by long practice each man appeared to have learnt to aim pretty accurately at each compartment of the table, without taking his eyes off the letters in his hands. No doubt many mistakes would arise; occasionally two letters would meet, and arrest each other midway, but all errors were rectified in the final process, which consisted in each man's arranging his own letters in the proper order for delivery. I am not prepared to express any opinion on the comparative advantages of this plan and of that practised in the London office."

"*Public Notifications.*—At each Post-office in Paris a board is placed outside, near the letter-box, on which is the following inscription:—

LETTER BOX.

Letters for Paris
put in the Box now, will be
delivered

(A)

from [two to four.]

General Post
and Foreign Letters
put in (B) the Box now,

(A)

will leave [to day at six.] in the evening.

N.B. On Sundays and holidays, after the removal of the box, corresponding with the delivery from 4 to 6, country letters will not be sent till the following day.

[A, A). Holes in the tablet, through which the wheel behind is seen.

(B). Key-hole.

(The inscription is of course in French; but we translate it for the convenience of our readers.)

The hours are inscribed on a wheel, which, by means of a key applied to the

most, the water flows into a rivulet ornamented with several small islands, and overshadowed by a variety of intersecting branches. Fossils, petrifactions, and spars, constitute the inside of the grotto, which is also decorated with two white marble basons, and a statue of Venus, apparently rising from the bath. A mirror placed behind this statue reflects the whole scene with considerable effect. In this romantic spot, George the Fourth dined when he visited Stowe.

The Temple of Concord and Victory is a large handsome building, of an oblong shape, decorated with twenty-eight fluted Ionic columns. This is acknowledged to be one of the most chaste and elegant ornamented structures in the kingdom; and as long as it continues to exist, the architect will need no other monument to record his taste and judgment. It was originally designed by Kent, but the internal decorations were completed in 1763 by Signor Borra, when the late Lord Temple gave it the appellation which it now bears, to perpetuate the remembrance of the peace then ratified at Fontaniebleau.

Lord Cobham's Pillar, on the other side of the valley, is 115 feet high, surmounted with a statue of his Lordship. It was originally designed by Gibbs, but has been altered by Valdré, who enlarged the pedestal, in order to receive four lions, that are now placed on the angles. The view from the top will repay the trouble of ascending. Near this column is a beautiful temple, called

The Queen's Building, originally designed by Kent, since whose time it has been augmented by a Corinthian portico, leading to a large elegant room, decorated with scagliola columns and pilasters, supporting a trunk ceiling, executed from the design of "the Temple of the Sun and Moon" at Rome. On the opposite side of a deep valley, is the most picturesque and curious building in the gardens, denominated

The Gothic Temple. This is a triangular building, with a pentagonal tower at each corner; one of which rises to the height of seventy feet, and terminates with battlements and pinnacles; the others are surmounted with domes. The whole is constructed with a brownish stone, and being seated on the brow of a hill, forms an interesting object from many parts of the gardens. The inside is richly ornamented with light columns, and various pointed arches: and the windows are glazed with a fine collection of old painted glass, on which a variety of sacred subjects and armorial bearings are represented. The principal room is circular; and its dome is ornamented with the descents and intermarriages of the Temple family, in a regular series of armorial bearings, from the Saxon Earls of Leicester, to the late Lord Viscount Cobham, and Hester, Countess of Temple, his sister and heiress. Two of the towers contain small circular chapels, decorated with painted glass, of the armorial bearings of different families. In the other tower is the stair-case leading to the gallery on the second story, where there are two other small chapels, with the arms of the Saxon heptarchy. This stair-case leads to the top of the highest tower, where a very extensive view is obtained, comprehending the greater part of the domain. In a woody recess, near the temple, are some good statues by Rysbrack, of the seven Saxon deities who gave names to the days of the week; on each of which is a Saxon inscription. At the bottom of a gentle declivity is

The Palladian Bridge, so denominated from being built after a design by the celebrated Italian architect, Palladio of Vicenza. It has one large, and four small arches, and is decorated with a balustrade on each side, and sixteen Ionic columns supporting a roof. This bridge is built of the same shape and dimensions as that at Wilton in Wiltshire, the seat of Lord Pembroke. Near it is

The Temple of Friendship, built in the Tuscan style of architecture, and ornamented with a portico, supported by four columns. The inside is furnished with busts of the following celebrated and noble personages: — Frederic, Prince of Wales, Earl Chesterfield, Earl Westmorland, Earl Marchmont, Lord Cobham, Lord Gower, Lord Bathurst, Richard Grenville, late Earl Temple, William Pitt, late Earl of Chatham, George, late Lord Lyttleton.

The Pebble Alcove and Congreve's Monument, executed from a design by Kent. This is decorated with emblematic devices, expressive of the poet's peculiar bent of genius in dramatic compositions. On the top sits a monkey viewing himself in a glass.

Such are the principal objects in these celebrated gardens, where, as Walpole observes, "the rich landscapes occasioned by the multiplicity of temples and obelisks, and the various pictures that present themselves as we change our situation, occasion both surprise and pleasure, sometimes recalling Alban's landscapes to our mind; and oftener to our fancy, the idolatrous and luxurious vales of Daphne and Tempe."

THE CHEMIST.

ACIDS.

NO. VII.

Manganesic acid may be obtained as follows :—Two parts of nitrate of baryta, are mixed with one of peroxide of manganese, and exposed to a red heat ; a green mass is obtained, which is to be reduced to fine powder, mixed with twenty-five parts of water, and a stream of carbonic acid passed through the mixture, which is kept constantly stirred, carbonate of baryta is formed, and a deep violet-coloured solution of manganesic acid. When the diffused powder has lost its green colour, the fluid is poured off and boiled for a quarter of an hour, to expel excess of carbonic acid, during which, a portion of carbonate of baryta and peroxide of manganese are precipitated. The clear fluid is boiled down to one-fourth its bulk, again left to become clear, and ultimately evaporated to a small bulk ; during this evaporation, oxide of manganese is again separated, in consequence of the decomposition of part of the acid ; but the residuary solution forms acicular crystals of hydrated manganesic acid on cooling. All attempts to deprive this acid of water have failed. Its solution has a peculiar astringent taste, possesses considerable bleaching powers, and exhibits a violet colour by transmitted light, but appears of a carmine red by reflected light. It is decomposed by boiling, especially when diluted, and also by exposure to the sun's rays. It forms salts termed *manganesates.*

Margaritic acid may be obtained as follows :—When soap, composed of hog's lard and potassa, is put into water, a portion only is dissolved, the remainder consists of white scales, composed of the alkali united to a peculiar acid, called by Bevreul, from its pearly appearance, *margaritic* or *margaric acid*, and separable from the above combination by hydrochloric acid. It is insoluble in water, tasteless, fusible at 134°, and crystallizes on cooling in brilliant white needles. It is soluble in alcohol. Its compounds are termed *margarates.*

Oleic Acid.—The portion of the hog's lard soluble in water (mentioned in the above preparation), consists of another peculiar substance united to potassa, which is called *oleic acid.* It may be obtained from its solution by tartaric acid, which causes it to separate in the form of an oily matter, that is to be again united to potassa, and separated as before. This substance solidifies at about 40°, and it forms compounds called *oleates.*

Oxalic acid is found in some fruits, and in considerable quantity in the juice of the oxalis acetorilla, or wood sorrel, and in the varieties of rhubarb. It is most readily procured by the action of nitric acid upon sugar, and hence it has been termed *acid of sugar.* It may be obtained by introducing into a retort four ounces of nitric acid, diluted with two of water, and one ounce of white sugar ; nitric oxide gas is copiously evolved, and when the sugar has dissolved, about one-third of the acid may be distilled over ; the contents of the retort are then emptied into a shallow vessel, and in the course of two or three days an abundant crop of white crystals are obtained, and upon farther evaporation of the mother liquor, a second portion is deposited. The whole crystalline produce is to be again dissolved in water and recrystallized, by which the pure acid is obtained. In this way sugar yields rather more than half its weight of oxalic acid. Oxalic acid thus procured, is in the form of four-sided prisms, transparent, and of a very acid taste. The crystals dissolve in two parts of water at 60°. Its compounds are termed *oxalates.*

Phosphorous Acid.—If phosphorous and corrosive sublimate (bichloride of mercury) be exposed to an elevated temperature, a liquid called protochloride of phosphorus is formed ; if water be added to this, it resolves it into muriatic and phosphorous acids. With a moderate heat the former is expelled, and the latter remains. It can also be procured by burning phosphorous in a tube, with very limited access of air and caution as to temperature ; it may be easily collected in the form of a white volatile powder, which, when exposed to air, becomes hot, inflames, and burns into phosphoric acid. It rapidly dissolves in water, has a sour taste, reddens vegetable blues, and combines with certain of the solifiable bases to form salts called *phosphites.*

To prevent danger from leaving a Poker in the Fire.—Immediately above that square part of the poker, by blacksmiths called the *bit*, let a small cross of iron be welded, about an inch and a half each way. The good consequences of this simple contrivance will be,—1st, if the poker, by the fire giving way, should slip out, it will probably catch on the edge of the fender; 2d, if it should not, it cannot injure the hearth or carpet, as the hot part of the poker will be borne up some inches; and, 3rd, the poker cannot be run into the fire farther than the bit, which, in regard to a polished poker, is also of some consequence.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 28, G. A. F. Wilks, M. D., Lecturer at the North London and Westminster Hospital Schools of Medicine, on Botany. At half-past eight.

St. Pancras Literary and Scientific Institution, Coloseum House, New-road. Friday, Nov. 22, Dr. N. Rogers, on the Mythology of the Ancients (in conclusion. At half-past eight.

QUERIES.

Will your talented correspondent "Proportio," or any other of your intelligent correspondents, be kind enough to give an opinion on the present appearance of the skew bridge, which crosses Jonner-street, belonging to the Greenwich railway? The rent in the arch extends from the spring on one side to the foot-path on the other.

W. R.

A composition which will prevent leather from cracking, and where I can purchase a small quantity? Also, how I can make a hydrometer, such as we see in the shops made of cardboard, in various shapes; such as a monk whose cowl is raised over his head in wet weather, or a house, from which a man or woman comes out, the one in wet, and the other in fine weather. I believe it is cat-gut which causes the motion by shrinking; if so, how to apply the cat-gut, &c.?

A READER FROM THE FIRST.

How engineers calculate the speed of a paddle-wheel? Do they calculate from the speed of the extreme outer edge of the paddle-board, or do they take the speed from any other part of the paddle-board?

A. P. F.

ANSWERS TO QUERIES.

Having read of frequent inquiries for models of steam-engines in your magazine, I beg to inform those of your correspondents who may want such, that I have a cylinder and slide to dispose of, of peculiar construction; the dimensions of which are—height, 8 inches, with 7-inch stroke, and made for a diameter of 2½ inches. The whole of it is made substantially of white metal, and has a very handsome appearance. May be viewed at No. 5, Richmond-place, East-street, Walworth.

CICERO.

To make Carmine.—Four ounces of finely-powdered cochineal are to be poured into four or six quarts of rain or distilled water that has been boiled in a pewter kettle, and boiled with it for six minutes (some advise to add during the boiling two drachms of pulverised crystal of tartar), eight scruples of rock alum in powder, and then to be added, and the whole kept upon the fire one minute longer. As soon as the gross powder has subsided to the bottom, and the decoction has become clear, the latter is to be carefully decantered into large glasses covered over, and kept undisturbed till a fine powder is observed to have settled at the bottom; the superabundant liquor is then to be poured off from this powder, and the powder gradually dried: this powder is carmine. From the decantered liquor, which still contains much colour, the rest of the colour may be separated by a solution of tin, which yields a carmine little inferior to the other.

A JUVENILE ENTERTAINER.

Another Method.—Twenty ounces of cochineal is to be boiled in two gallons of water, adding sixty grains of alum; then pass it through a fine cloth to remove the cochineal; heat the liquor again, and pour into it a saturated solution of muriate of tin until the carmine is precipitated.

To make Blue Ink.—"V. T. L." Take of ferrocyanide of potassium, quarter of an ounce; oxalic acid, quarter of an ounce; dissolve these in half a pint of rain water; then add half an ounce of the tincture of sesqui chloride of iron; stir well together, and dissolve half an ounce of gum Arabic in the solution. This does not change colour, neither have the acids any effect upon it.

J. MITCHELL.

To Melt Brass in small quantity.—I would recommend "G. G." in your queries to purchase the book you have quoted, "Chemistry no Mystery," and read pages 2 and 200, and he will see how to melt brass by means of a common candle.

To take Stains out of Crimson Silk, cannot be done without discharging the colour *in toto*.

To Prepare Paper for Painting on.—"T. H." This may be done by means of a weak solution of isinglass being laid over the surface, say two or three coats, allowing each to dry before the other is applied; and an excellent varnish for the same, after painting, may be made by mixing equal parts of Canada balsam and spirits of turpentine.

Carbonic Acid Gas may be made with chalk or whitening and oil of vitriol. W BARTLETT.

Chelsea.

TO CORRESPONDENTS.

J. Mitchell.—*We shall be glad to receive any communication from the talented writer of the papers on chemistry.*

J. A. J. *shall be attended to.*

S. H. H.—*The weight of a person is not affected by any peculiar state of respiration; the experiment must have been misunderstood, and should be classed with the notion, that a fish put into a pail of water will not increase the whole weight, or that a person is not heavier after taking his dinner, and others of a similar kind; they have no foundation in truth.*

P. P. *will see, in our next, some observations on the subject of the proposed fourpenny postage; we look upon that measure with much suspicion, but trust that the energy of the nation will ultimately cause the intentions of the legislature to be carried into effect.*

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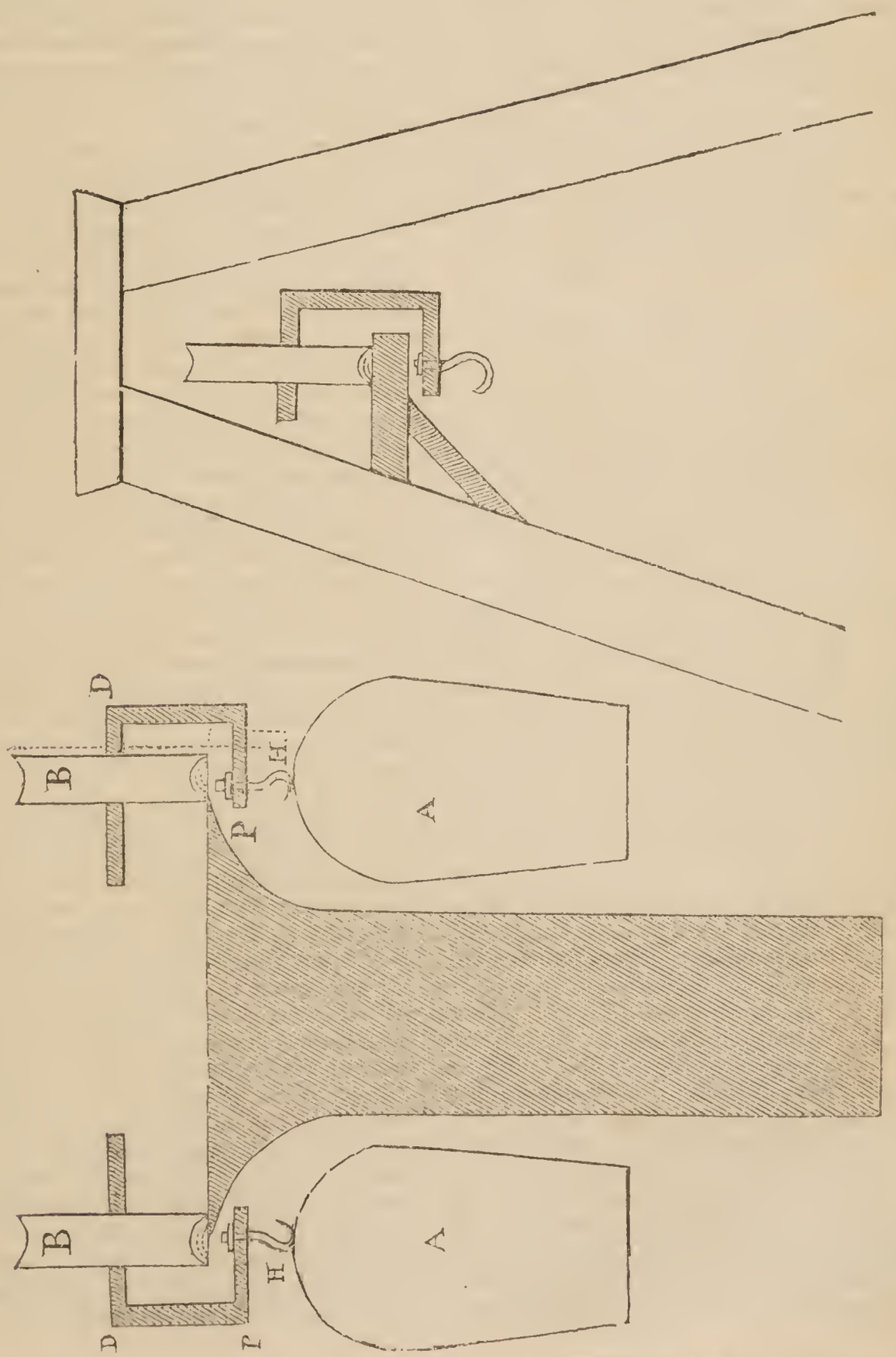
JONES'S UNAROTA RAILWAY AND RAILWAY CARRIAGE.



VOL. V.—No. 14. City Press, 1. Long Lane, Aldersgate Street : D. A. Doudney.

JONES'S RAILWAY.

To the Editor of the Mechanic and Chemist.

(See engraving, front page.)

Sir,—I herewith send you a sketch of what might perhaps be styled a novel invention, being nothing more or less than a railway carriage upon one rail and one wheel; perhaps some of your ingenious readers may be able to turn the suggestion to some good practical account.

Fig. 1, A A, are two separate and independent carriages; B B, their wheels, which revolve around the axles, D D, upon the rails underneath; Fig. 2, is the same principle applied in another manner for crossing deep valleys, marshes, &c. By fixing a spur wheel upon B, and another upon the arm, P, it could be easily driven by an engine in the carriage. Any farther remarks are unnecessary, the drawing will be easily understood upon inspection. I remain yours, &c.,

Wm. Jones.

MR. CHARLES GREEN'S INTENDED VOYAGE ACROSS THE ATLANTIC IN A BALLOON.

The aerostatic art has for many years past attracted the attention of scientific men, but little or no progress has been made towards the application of balloons to any purpose of practical utility. Most writers on this subject have fallen into the error of directing their researches towards objects which can never be attained, or which, if successfully achieved, would in no degree advance the solution of the great problem, of rendering the science of aerostation serviceable to mankind. Of the first description is the attempt to guide a balloon, by means of sails or wings, in any required direction; now it is clear that in a uniform current of wind, no construction of sails on the principle of navigation, can alter the motion of the machine, since it moves with the same velocity as the wind, and consequently receives no impulse, but goes on with the force of its own inertia, which continues till external impediments destroy it. There are also insurmountable obstacles to the successful application of wings in imitation of the flying of birds, or the swimming of fish; the power of the wind acting on so large a surface as that of a balloon must necessarily be, far exceeds that of any machine at present known, within the required limits of size and weight; and even admitting that sufficient power could be obtained, the violent agitation and strain upon the machine, would render it practically impossible to employ it. Much time and labour, and even life, have been expended in the construction of parachutes—machines which must ever be attended with considerable danger, and even in their most perfect form, would be utterly useless, since the same object may be attained by a separate balloon of small dimensions, which might be detached should it be required to send down one or more of the passengers before the descent of the principal machine.

Mr. Green's project of crossing the Atlantic, will no doubt create much interest throughout the scientific world; and should he succeed, as we most fervently hope he will, he may claim the honour of making the first step towards the useful application of ballooning.

Mr. C. Green has authorised the following statement of the grounds upon which he founds his assertion of the possibility of making a journey in a balloon from New York, across the Atlantic, to Europe. He states that balloons inflated with carburetted hydrogen, or common coal gas, will retain the fluid unimpaired in its buoyancy, and very slightly diminished in quantity, for a great length of time; whilst, on the contrary, the pure hydrogen is so subtle a gas, and capable of so great a degree of tenuity, as to escape through the imperceptible pores of the silk, whether prepared in the ordinary manner, or by means of dissolved India-rubber. These facts are the result of observations made during 275 ascents; on many of these occasions, a smaller balloon has been filled at a neighbouring gas-works, and has been brought a distance of five or six miles to fill that in which he intended to ascend, retaining, in many instances, its contents nearly the same in quantity and quality for nearly a week. The aeronaut has travelled 2,900 miles with the same supply of gas, and could have continued its use for three months if necessary. As to making the voyage from America to Europe, Mr. Green states its possibility from the following facts:—On all occasions in which the balloons in which he or other aeronauts have gained an altitude beyond the lower current of air, or land breeze, they found one uniform current of air coming from the Atlantic, and blowing west, north-west, or west by north, whilst the under winds, from different causes, were blowing from points completely at variance with the above; the ascent of the machine into these upper currents is perfectly easy, and the same altitude may be kept for an indefinite time with equal facility.

In 1836, Mr. Green made a proposition at Paris to cross the Atlantic in a balloon, when he received a letter from Admiral Sir Sidney Smith, confirming his observations as to the directions of the upper currents, and in which that gallant officer states his conviction of the safety of the proposed undertaking, and his readiness to accompany the aeronaut from New York to Europe in his balloon. It must be kept in mind, that a balloon is not borne along as is a ship by the force of the wind, having to overcome the impediment interposed by passing through a denser element like the water, but is a body lighter than the air itself in which it floats, and is wafted at the same speed as the air itself travels, as if it were a part of the moving body. The wide expanse of sea offers no impediment to the undertaking, and a machine as large as the Nassau balloon could easily be fitted up for the reception of three persons, and victualled for three or four months if necessary. The machine could be lowered to the earth and ascend as often as it pleased the voyagers, by the adoption of the same plans as those used in the voyage to Germany. Mr. Green having established the facts of a current of air continually passing round the earth in the direction of west-north-west, the capability of his machine to retain the carburetted hydrogen gas for an unlimited time, and of its power of sustaining itself in the air for weeks—under these circumstances, and trusting to the faith he has always endeavoured to keep with the public, as a claim to their confidence on this occasion, offers to take upon himself to traverse the Atlantic from New York to England, in a balloon to be constructed for that purpose, and that he will make the experiment without any reward for his exertions.

POST-OFFICE REFORM.

After many fruitless attempts to move that ponderous mass, the administration of the British Post Office, a mighty lever was obtained, capable of overcoming its inertia, and giving a proper direction to its motion. That lever was the appointment, last year, of a Committee of the House of Commons, to examine and report upon Mr. Rowland Hill's plan for establishing a uniform penny postage throughout this kingdom. After a protracted and laborious investigation, and the examination of three hundred witnesses, the Committee drew up an elaborate report, asserting the practicability of the system propounded by Mr. Hill, and recommending its adoption, not as a matter of convenience to a few, or as a source of revenue and patronage, but as a great national measure, calculated to promote the best interests of society—a consideration of paramount importance with all well-wishers to their country. Even the *Quarterly Review*, an enemy to the measure, declares that "No one can rate higher than we do the paramount advantages of a cheap, rapid, and certain post-communication to the commercial, intellectual, and social interests of mankind. *That*, we repeat, is the first object—the consideration of revenue is subordinate—very important, no doubt, but subordinate." As the friends and supporters of this great measure increased in numbers and influence, its opponents became more tractable, and qualified and tempered, or wholly abandoned their opposition. The wishes of the nation, expressed by thousands of petitions, and supported by unanswerable arguments in the House of Commons, at length prevailed, and the uniform penny postage was decreed by an overwhelming majority of the legislature. We rejoiced in anticipation of the speedy attainment of the desired object, but recommended the friends of the Bill to be vigilant, lest the insidious manœuvres of its opponents, and the astuceous perfidy of some of its pretended friends should prevail, and prevent the intentions of Parliament from being carried into effect. We have now still stronger reasons for believing that our fears were not unfounded. Mr. Hill has been sent to Paris by the British government, and, by comparing dates, it appears that a loose and remarkably unskilful document, called a "Treasury Minute," has been concocted during his absence; it is a sort of half, or rather a quarter measure, prescribing a fourpenny postage to distant places, and in the London district, the most important in the kingdom, a complication of absurdities which will be found extremely inconvenient to commerce, and, in many cases, more costly than the old system. Some letters are to be pre-payed, others are not; some are to be charged by weight, others are to be charged according to the old system—in short, if it were intended to discredit the measure for the purpose of depriving the nation of the promised benefit, a better plan could scarcely be pursued. A vast majority of the people of this country desire the uniform penny postage; but its enemies, though comparatively few, are powerful and active; and nothing short of the most vigorous, unanimous, and unceasing exertions can insure its ultimate triumph.

RAILWAY *versus* STAGE-COACH TRAVELLING.

THERE is no country in the world where stage-coaches are so well "appointed" as they are in Great Britain, in the matters of speed, safety, regularity, and comfort—but these merits are growing old fashioned; and steam carriages are the popular wonder, as well they may be. Without, therefore, intending disrespect to the old vehicles, which have carried us so long, so fast, and so far, it may be useful to point out some of the more obvious circumstances of advantage pertaining to the road steamers, as at present managed. In the first place, on going to the booking office in connexion with the coach, after weathering a dousing rain, we are sometimes greeted with the very unpleasant response, "No room inside, ma'am,"—or gentlemen after panting a mile in the middle of one of the dog-days learn, that "every outside place is taken." This never happens at the railway station—there is always room—be the passengers ten, fifty, or five hundred, it matters not—all are booked—all get the best places! In starting the railroad trains, there are none of those terrific piles of luggage, which often render many of the coaches so frightfully and dangerously top-heavy. A passenger, who must often be reasonably alarmed at the lading of a coach, sees or hears packages of almost any number, weight, or bulk, placed on the railroad carriage without the slightest apprehension. And then in taking your places, there is no competition for the "box seat," or the "front seat,"—no clambering over dirty wheels, excoriating your shins on sharp irons, until wedged amidst piles of luggage, your seat is taken on the lofty unsheltered platform, round which numerous legs hang dangling like a dozen brace of black and white grouse. To be sure the roof of a coach is sometimes pleasant enough on a fine summer's day, with a fine country on either hand, and a good road below; and even when it rains, if you happen to have an umbrella, and if your neighbour, being without, should happen to be good natured enough to endure the drip upon his neck, all may be tolerable, though anything but comfortable; but in the railroad carriage there are no outside places. Every passenger is sheltered, whether the poor woman that pays sixpence to ride six miles, or the rich man that pays one pound to ride a hundred. And then what a mechanical miracle is railway speed! How the train, whatever its length, does bowl along! What a "hish" on passing a bridge or another set of carriages. How the objects on each side flit by—how the colts, calves, and sheep, scamper off in surprise—how the cottagers come to their doors and the husbandmen pause in their work, to gaze and wonder! And yet, amidst all this astounding speed there is no plying of the whip, no tugging at the reins—no cruelty to horses. And who, possessed of any sensibility, can witness the turgid veins, the lathering skin, and the frothing mouth of the generous steeds, without some misgiving as to man's right so to use—or rather abuse God's creatures! The locomotive steam-engine, indeed, as if it were a thing of life, does sometimes pant and snort in grand style; but animal sensibility is not present—the bones here are iron and brass—the circulating fluids are water and vapour—the tireless tendons are rods of steel. Here, no hair-brained passenger is allowed to urge the driver on to hazard the lives or limbs of his companions; the engineer is the sole judge of fast or slow—he never for a moment either listens to bad advice, or lends the rein to an amateur driver. But it will be said a wheel may fly off or break. What then? It is true, the leaping out of a linch-pin, or the smashing of a felloe, must lead to the upsetting of a coach—but a railroad carriage can afford to lose one or two wheels, and nothing serious be the matter. At any rate, the boiler may burst—and then terrible would be the consequences? But whoever heard of a railroad boiler bursting? No one; the fact is, the boiler cannot burst—as any person may presently satisfy himself, from an inspection of the construction of one—it will be found to be formed in the middle of a series of tubes, any of which bursting, would cause a pretty buzz in the casing—but nothing more. But assuredly sometimes, after all, terrific accidents occur. So they do; but under what circumstances? Why, in nearly all instances, from the negligence of individuals who ought to have kept out of danger. It is very certain, that if a person chooses to place himself in the way of a passing train, he will be as certainly run down by a train of steam carriages as by a stage-coach, *plus* the velocity and numbers of the former. But bating cases of this kind, nothing is more remarkable in the history of steam travelling, than the small amount of injury to life or limb, which has been sustained; the instances of fatality arising solely not from any cause peculiar to the steam machinery as such, are few indeed, or rather none at all—for it is very remarkable, that, as yet, not one person has

been killed by any accident arising from the nature of this kind of locomotion exclusively. In the last place may be mentioned the comfort arising from the regulation, that no fees are given to servants. —*Railway Mag.*

STEAM COMMUNICATION WITH INDIA.

A Letter written on board the Atalanta *Steamer, and sent by the* Berenice.

"I GOT to Bombay on the morning of the 23rd, having left Agra on the 2nd, this includes two days' stoppages. I think, however, to perform the journey in any comfort, six camels and thirty days, so as to allow of longer halts, would be necessary. I kept the Dawk road the whole way, going direct from Gwallor by Seperes and Saringapore to Rajwas, where Captain M'Mahon's Russallah is stationed, then to Indore. Somewhat less than sixty miles from Indore, I descended the Jhaum Ghaut, a road very trying for the camels' feet, to Mundlesur; and thence, by a most miserable road, through a rocky jungle four days, to Dhoolia, *via* the Sindwa Ghaut. The latter is in Candeish, and the first Bombay station on the route. Thence to Bombay are staging bungalows, at convenient distances, and bearers can be procured in sets to go the whole distance. The country under the native chiefs is desolate, that is, compared to the Bengal provinces. No trade; people poor; but impudent and uncivil only in Seindia's and Holkur country. The Bombay territories in Candeish do not certainly give a cursory observer a favourable idea of their condition. Whether the Ryotwa system is to blame in this I don't know certainly; but I cannot help thinking that the arguments against it are as forcible in practice as in theory; still the people are much better off than in the native States. The journey to Bombay from Agra will, I doubt not, be frequently performed a few years hence; at present we do not know anything about it. The road I came has, I believe, advantages; but the voyager must not think his trouble at an end on reaching Bombay; or that the steam-packets are equal to passenger-Indiamen in accommodation. In fact, I cannot conceive how a lady manages. We have, however, five; there are only seven very small cabins, into each of which two people are crammed: no room to swing cots. Eight other deluded individuals (of whom I am one) are given to understand, that a cabin passage is included in permission to sleep on the benches and tables of the cuddy. For this you pay 200 rupees extra. The vessel is dirty beyond measure, from the soot and with the difficulty of copious ablution; and private accommodation is almost worse to a lover of Indian habits than the journey to Bombay from Agra on camels. No civility is to be got from the officers. If they are not directly uncivil, you are luckier than we have hitherto been. They declare themselves disgusted with passenger-ships, but do not take the proper way of showing their superiority to the duty. Egypt is, I hear, still plagued with four-footed things; indeed the Bombay Presidency suffers in some degree from a like pestilence; and the steamers on the other side are said not to be better than on this. One thing, we have abundance of good food, and good plain wines. We have only to shut our eyes to the process of the *cuisine*, and all is right."—*Bombay Times*, June 8, 1839.

THE STEAM MEETING AT MOORSHEDABAD.

June 3, 1839.—We record with sincere gratification the proceedings of the general meeting for the furtherance of the great cause of Comprehensive Steam Communication, which took place at this station this day. The attempt of our zealous chairman to secure to his noble enterprise the aid of a new and combined effort of all classes and castes of our community has, we rejoice to say, met with the most encouraging success. A crowded assembly of the principal European inhabitants, the Moosulman nobility of Moorshedabad, and the titled and other Hindoo gentry of this station—a longer list of distinguished names than it has ever before been the lot of our scanty columns to sustain—evinced in the strongest terms the interest with which all ranks of this society regard the splendid project of drawing closer the bonds of union between India and her island mistress, by means of the rapid intercourse of navigation by steam. Religious enthusiasm, commercial and agricultural enterprise, and the thirst for social and intellectual improvement, were alike appealed to; and a series of resolutions, supported by several of the highest personages in both sections of the native community, and carried by the unanimous voice of the meeting, called on all zealous Moosulmans, on the merchant and landholder, and on every friend, whether Hindoo or Mohamedan, to the prosperity of his native country, to join in promoting the success of a scheme which, in the comprehensive circle of its promised

benefits, was fraught with advantage to all classes of Indian society; and as an earnest that the assembly was prepared to act as well as talk, fifty-nine shares taken on the spot, have raised the united purchase at the two Berhampore meetings to eighty-two shares, and placed at the disposal of the Directors of the New Bengal Steam Fund in England, towards the realization of this noble undertaking, the sum of 41,000 rupees in the name of the society of Moorshedabad.

ON METALS AND THEIR COMBINATIONS.

The word metal in chemistry is applied to any substance which possesses the following peculiar properties:—1. It must conduct electricity and heat. 2. When the compounds which it forms with oxygen, chlorine, sulphur, &c., are properly submitted to the action of a powerful galvanic battery, decomposition ensues, the metal always appearing at the negative pole of the battery; it is therefore said to be a positive electric. 3. Opacity, for although hammered into thin leaves, it refuses a passage to light; take gold leaf, for example, which does not exceed the $\frac{1}{282020}$th of an inch in thickness. They are generally good reflectors of light, possessing a peculiar lustre, which is called the metallic lustre. Every element which possesses these properties is termed a metal.

The number of metals known up to the present time is forty-one. The following are the names which have been given to them, and which for conveniency are divided into two classes:—

Class 1. Metals which by oxidation form alkalies and earths.

Potassium	Aluminum
Barium	Zirenium
Magnesium	Lithum
Glacinum	Calcium
Sodium	Therium
Strontium	Ytrium.

Class 2. Metals, the oxides of which are neither alkalies nor earths.

Manganese	Bismuth
Tin	Copper
Nickel	Silver
Vanadium	Palladium
Columbium	Iridium
Cerium	Iron
Tellurium	Cobalt
Mercury	Chromium
Platinum	Tungsten
Osmium	Uranium
Zinc	Titanium
Cadmium	Lead
Arsenic	Gold
Molybdenum	Rhodium.
Antimony	

Most of the metals have a great specific gravity, which was thought to be a general property of them, until the researches of Sir Humphrey Davy in discovering potassium and sodium, proved it to be an error. Malleability, ductility, tenacity, hardness, and solidity, are properties possessed by some metals. Mercury is the only metal which is fluid at common temperatures. Some metals are volatilized by heat, such as cadmium, arsenic, mercury, &c., while others are, on the contrary, quite fixed. Some metals readily combine with each other, forming alloys, except those in which mercury is a constituent, which are called amalgams. An amalgam of tin is used on a large scale for silvering of looking-glasses. The amalgam used for exciting the electrical machine, is composed of 1 part of zinc, 1 of tin, and 2 of mercury; the zinc and tin should be melted first, and the mercury then stirred in. Gold readily combines with mercury, forming a white-coloured amalgam. Potassium and sodium also unite with mercury, forming solid amalgams; they are separated by the addition of water, a solution of potassa being formed, while the mercury falls to the bottom. There are several alloys of copper, bronze, bell-metal, and speculum metal; for telescopes are copper alloyed with tin, differing only in proportion. Copper alloyed with zinc in different proportions, forms the various kinds of brass, Dutch gold, &c. Copper alloyed with a small quantity of arsenic, forms an alloy so white, that it has been mistaken for silver. Spoons and other articles which used to be sold under the name of British plate, and are, I believe, now selling, were probably made of this alloy; but as I have not proved the existence of any other metal than copper at present, I cannot presume to state that arsenic is a constituent.

A. Taylor.

(To be continued.)

MISCELLANEA.

South-eastern Railway—The Shakspeare Tunnel.—This tunnel, with its lofty Gothic arches of thirty feet high, begins to shadow forth its ultimate effect. The passage through, our readers are aware, has long been completed; but as this excavation is principally that stratum of the chalk, called by Phillips "the chalk of abundant organic remains," which possesses the property

of being at the same time of great hardness and in small detached masses wanting cohesion, the progress has not hitherto been so rapid; and in many places more brick arching has been used than was at first contemplated. The work is beautiful in its execution, and of great durability. Passing through this tunnel, we come upon a vast platform, which forms the termination of Shakspeare Tunnel, and the commencement of that of Abbot's Cliff. This latter is longer than the former; but as the chalk is much freer in its working, and more cohesive, some alterations will be permitted in the size and height of its tunnel, so as to admit of its being more expeditiously worked. The shafts, drift-ways, and galleries of this tunnel are complete. Beyond this, one comes upon the wall, now in a state of forwardness; this wall is formed from a concrete of the grey chalk, or Halling lime, and the beach of the seashore. Its base is about thirty feet in thickness, and decreased upwards: and the top of the wall will be about twenty feet above high-water mark; that part of it approaching to completion is very hard and appears of great durability. From this wall a gallery leads to Little Switzerland, or the Warren; and through the Warren the railway is conducted to Martello Tower, No. 1. The earth cuttings in this part are proceeding very rapidly, there being nearly four hundred men employed in a short space. At Tower, No. 1, the road turns and continues to Beachborough hill in a straight line, passing over the junction of the Dover and Canterbury roads in its progress; the bridge for this viaduct is commenced. Of the farther continuation of the line we know but little more than that we hear everything is going on successfully. The present pressure upon the money market has, doubtless, much influenced the price of these securities, in common with others; but it must be some consolation to distant shareholders to learn that, though the value in the market has receded, the expectations and confidence of the local proprietors have risen more than cent. per cent. during the last few months, convinced, as they appear to be, that the natural difficulties which have opposed themselves hitherto, are disappearing rapidly before the well-directed energy and perseverance of the conductors.—*Dover Chronicle.*

Pilgrimage to Ferney.—"More than ten thousand strangers visit annually the country-house of Voltaire, at Ferney, near Geneva. It may be, therefore, supposed, that the post of cicerone is productive to its owner. A Genevese, an excellent calculator, as are all his countrymen, has valued as follows the yearly profits that functionary derives from his situation.—8,000 busts of Voltaire, made with earth of Ferney, at a franc a piece, 8,000 francs; 1,200 autograph letters, at 20 francs, 24,000 francs; 500 walking canes of Voltaire, at 50 francs each, 25,000 francs; 300 veritable wigs of Voltaire, at 100 francs, 30,000 francs. In all, 87,000 frans."—[The above story has just started on its travels to "go the round of the press." The owner of the Chatau Voltaire not being unknown to us, we take the liberty of contradicting that part which relates to unfair traffic with spurious articles. The bed-room is preserved with the original furniture as when occupied by the great philosopher. It contains a portrait of Frederick of Prussia, presented by that Prince to M. Voltaire, and one of Dr. Franklin, who was a great favourite with Voltaire. There is an urn containing the heart of "the universal legatee of the age of Louis XIV.", with this motto;—"Son cœur est ici, son esprit est partout." (His heart is here, his mind is everywhere.) The liberal owner of the chatau (M. de Budet) submits to some degree of annoyance, for the accommodation of the public; no charge is made, but it is usual to give a trifle to the servant who conducts a party of strangers to "the lions" of the house and gardens, as is *allowed* in Windsor Castle, and *exacted* in several of our churches. We should not throw stones at our neighbours' windows, when our own house is made of glass.]

Economy in Bread.—Boil 5 lbs. of bran in water, strain it, and with the liquor knead 56 lbs. of flour, adding the usual quantity of salt and yeast. The dough will weigh about 94 lbs. 13 oz., or 8 lbs. 10 oz. more than the same quantity of flour kneaded in the common way; the loss of baking will be about 10 lbs. 5 oz., the gain from the use of the bran being about 14 lbs., that is, a clear increase of one-fifth of the usual quantity of bread from a given quantity of flour. The bran, after being used in this way, is equally fit for many domestic purposes. Bread is greatly improved in flavour and colour by the addition of half a pound of rice (having been boiled fifty minutes in two quarts of water) to a peck of flour; and what is more, it increases the loaf very materially, and is the saving of one shilling in six.

Seasonable Hints on Guns.—Never take a loaded gun into the house, and never load it there, and never carry a gun in such a position as if, were it to go off, it must strike a fellow creature. It will be no excuse to others in such a case, or to yourself to say, "you did not think it would go off." No man has a right to be thoughtless that carries a loaded gun. The man who does not think, is deficient in the first qualification of a sportsman. Let us also warn our sporting reader never to carry his gun with the hammer resting on the nipple, lest in going through a hedge, or passing by anything or anybody, it should receive a blow, and the gun go off. Lastly, never use your gun to clear away thorns in a hedge, and never give your neighbour his gun with the muzzle pointed towards him or towards yourself. And, above everything, never point even an unloaded gun at anyone in sport. It may teach others to do the same thing where a gun has been loaded without their knowledge.

Sporting without Certificates.—A person sporting without a certificate is liable to three processes. First, a penalty, under the Game Act, of not more than five pounds, and on non-payment may be imprisoned, to hard labour or not, for not exceeding three calendar months; second, a penalty under the Assessed Taxes Acts, of not more than 20*l.*, nor less than 10*l.*, and on non-payment may be committed (if no goods to restrain), but not to hard labour, for not exceeding six calendar months; a surcharge, under assessed taxes, for double certificate duty, 7*l.* 7*s.*, and if no goods to levy upon, may be committed, but not to hard

labour, until the money is paid, unless the Board of Stamps and Taxes choose to liberate. It is the intention of the Commissioners to publish the names and residences of all persons surcharged in double duty for sporting without certificates. The judges have also recently decided that persons who are spectators of a hunt are also liable to double duty for a certificate, even though they may have been invited to join the party

Usefulness of Pheasants.—The pheasant is particularly beneficial to the farmer, a circumstance not generally known. This was fully proved a short time since at Whitney Court, Hertfordshire, where J. Day, Esq., shot a hen pheasant, in the craw of which, on being opened, were discovered more than half a pint of that destructive insect, the wire-worm.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-buildings, Chancery-lane. Wednesday, Dec. 4, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 5, G. A. F. Wilks, M.D., Lecturer at the North London and Westminster Hospital Schools of Medicine, on Botany. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Dec. 6, Dr. M. Truman, on Organic Matter. At half past eight.

QUERIES.

What is the plan laid down for setting out the longitudinal lines, and the parallels of latitude, on maps? H. P.

The way in which alcohol is stained of a blue colour, so as to be more apparent in spirit thermometers, &c.? It will not dissolve sulphate of copper T. S. R.

How to make cayenne and other kinds of lozenges? A. C.

Having read in Nos. 8 and 9 (N. S.) of your instructive journal, that a correspondent, "J. L." was so kind as to offer to give every information in his power to another correspondent, "A Subscriber," in reference to the construction of a velocipede, and being desirous of making such a machine, I beg to avail myself, with your permission, of the opportunity of soliciting a similar kindness. Being anxious of having a velocipede upon the most approved principle, I should be peculiarly obliged to any of your correspondents who might render me any information in reference thereto. T. IRELAND.

"What kind of an instrument is used by some of the teachers of systematic writing to fix on the hand of an adult who has got an inveterate habit of holding the pen wrong, and a very stiff hand to compel them to hold it in proper position?" I should feel much obliged also if your correspondent, who gave an answer to "H. R. S.," in No. 25, would describe the aidegraph, or state the name where it can be procured, as I tried all the shops likely where he mentions, and twenty other principal fancy stationers, &c., in London, and not any of them had heard anything of such an instrument. If you can give publicity to this in your valuable work, I trust it would not only prove interesting and useful to your humble servant, but if it should lead to the description of an instrument that would answer the purpose, prove invaluable to many hundred mechanics, who find great difficulty in overcoming stiff hands and bad habits. A SELF-TAUGHT SUBSCRIBER.

TO CORRESPONDENTS.

Gamma.—*The proper construction of toothed wheels, on a wheel and pinion, is a subject of considerable difficulty; till recently, the epicycloid has been considered the fittest form; but a spiral curve is now preferred. The size and shape of the acting surfaces being determined, the proper depth is that at which equal motions of the wheel, will communicate equal motions to the pinion, and* vice versa. *When there is a succession of wheels and pinions as in a clock or watch, there is,* cæteris paribus, *the greatest friction on the pivots or axes, when they recede from the first mobile in a straight line; and the minimum of friction is when the third wheel returns in a straight line towards the first, and the relative friction of any position may easily be shown, by the resolution of forces, the action of the wheel and pinion, being nothing more than a succession of levers. His other query we defer for the present, not being in possession of the facts required for an accurate answer; but it shall be answered or inserted at the earliest opportunity.*

Alpha.—*Do you recollect the fable of washing the blackamoor white? The attempt to persuade mankind to abandon vice, is equally vain; but he who by argument, example, or even by the severest coersion, does in any degree arrest the deadly contagion, renders an important service to society. Drunkenness is the Devil's hot-bed, where he sows the seeds of the most frightful crimes that degraded humanity blushes to own; and is one of the most conspicuous of the innumerable proofs that vice is misery, and virtue is happiness. Much might be said upon this subject; but it is not sufficiently technical for the "Mechanic and Chemist."*

In the Press, and will be Published on the 21st of December,

THE PEOPLE'S LETTER BAG.

PRICE ONE SHILLING.

To be had (by order) of all Booksellers in Town and Country.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOWNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

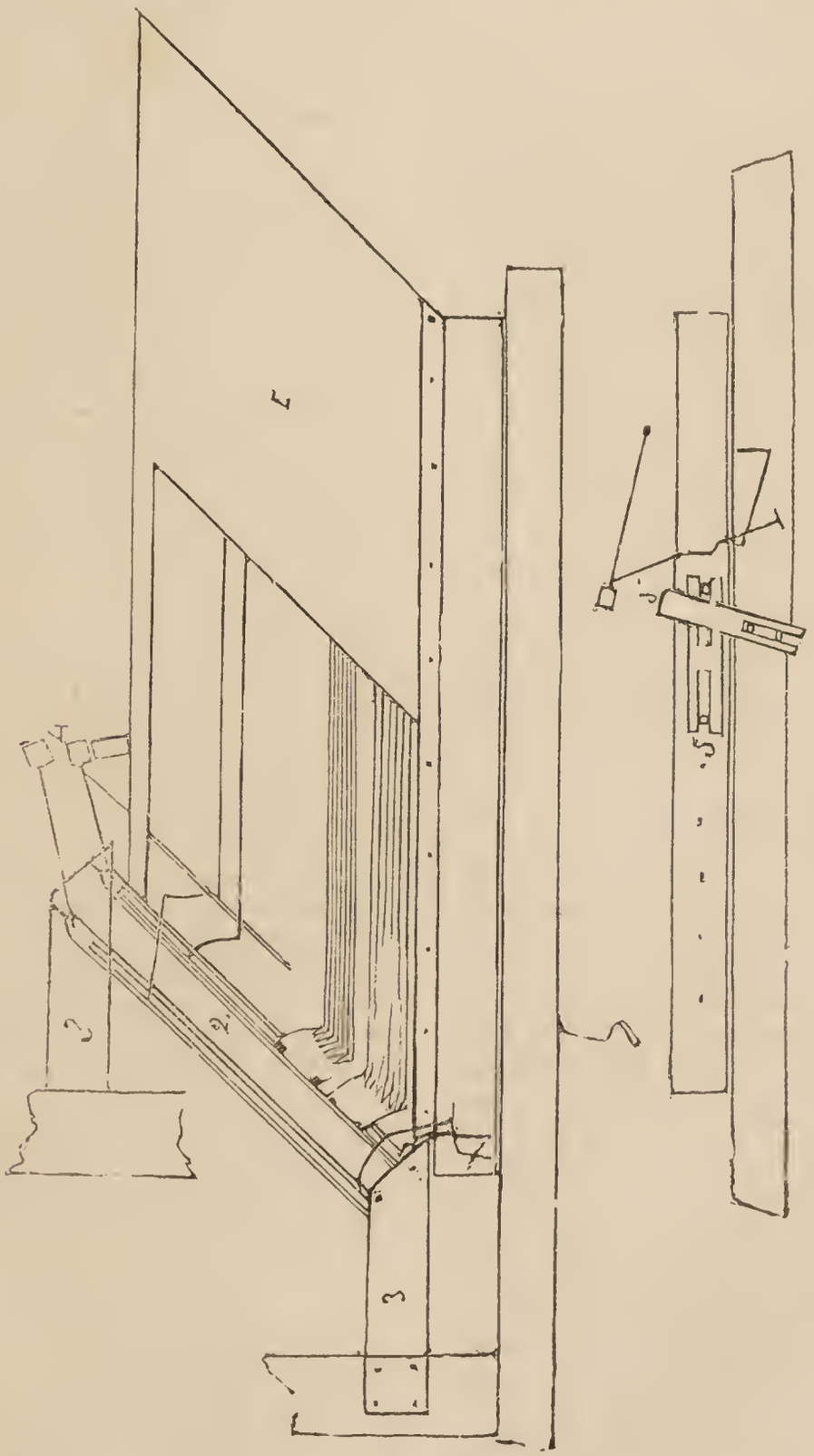
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 64, NEW SERIES. | SATURDAY, DEC. 7, 1839. PRICE ONE PENNY. | No. 185, OLD SERIES.

J. H. CARY'S RULING MACHINE, TO BE ATTACHED TO A PRINTING PRESS.

FIG. A. FIG. B.



VOL. V.—No. 15] City Press, 1, Long Lane, Aldersgate Street : D. A. Doudney.

CARY'S RULING MACHINE.

(See Engraving, front page.)

Fig. A; 1, is a deal board one inch thick, made the same size as the press-stone, upon which it is fixed in the same manner as a form of type; a piece of reglet is fixed on the board the whole length of the near edge, to place the sheets even with; 2, is a slide to hold the pens; it is formed of two strips of wood, each one inch wide, and three-eighths thick, glued together at each end, with a piece a quarter of an inch thick inserted between them, and 3 inches long, so that the two together form a slide one inch square, with a slit a quarter of an inch wide, reaching to within three inches of each end, into which the pens are fixed by small wood wedges; 3, 3, are two pieces of half-inch board, with brass pivot-holes let into them, in which the pivots in the ends of the slide turn; these boards are screwed to the sides of the press, so as to support the slides parallel to the front edge of the platen; at the farther end of the slide is a piece of stout iron wire, about six inches long, terminating in a lead knob, 4, which by its weight turns the slide partly round, bringing the pens to bear on the paper; another piece of wire is attached closely to the knob of a joint, and hanging down by the side of the press, as shown at fig. B, passes through a wire guide, rests on a flat iron stud driven into the side of the press, supporting the weight, and keeping the pens raised off the paper; 5, is a piece of iron plate fixed on the side of the sliding bed, with a pin in the centre projecting about half an inch, for the purpose of striking the supporting wire off the stud, when the press is wound in far enough, thus letting the pens down for ruling; 6, is another piece of iron plate, fixed on the frame of the press, the end of which catches the weight, to prevent so great a pressure on the pens. The wire for raising the slides is fixed at the near end, bent down, so that a pin projecting from the side of the bed shall strike against it in running back the press, just when the top edge of the board comes under the pens. This is all that is necessary when the lines are all of equal lengths; but when there is a lead line, some of the up lines are required to run through, and others to stop at it, as in the sketch, where a sheet is represented as fully ruled; then make use of an additional slide, which is placed over the first-mentioned one, into which the pens for ruling the short lines are fixed by means of a stout wire-holder, long enough to reach over the under slide, and bent so as to bring the pens in a line with the others; the rail of this slide falls on the knob of the under one, and the raising wire lies by the side of the other, but has an adjusting screw at its point for the pin to strike against, by altering which, this slide is made to rise before the other, sooner or later, according to the difference required in the lengths of the lines.

The method of using the machine is as follows:—Supposing the press open, the pens raised off the paper, the weights being supported on the stud, in the off-side of the press; having laid about half-a-dozen sheets of large smooth paper on the board to rule upon, lay the sheet to be ruled upon them, bringing the side closely to the reglet, and the top even with the top or left hand edge of the board; then wind in the press, when the bottom edge of the sheet comes under the pens, the knocking down plate, 5, having been adjusted according to the size of the sheet, the pen strikes the supporting wire off the stud, down falls the weight upon the end of the catch plate, 6, bringing the pens down on the paper for ruling, then steadying the sheet with one finger, when the top of the sheet passes under the point of the pens, the pin in the near side of the bed strikes the raising wires, lifting up the slides till the supporting wire rests on the stud in the off-side of the press; the sheet is then removed, and another placed, proceeding as before.

The advantages of this machine over those in general use, are—First, its simplicity and cheapness; secondly, that though it does the work as fast and as well as any other machine, it only requires one person, instead of two, or more; thirdly, when lines are of unequal lengths, instead of ruling them at twice, which is usually the case, they may just as easily be done at once, without requiring the least additional time or care.

When the ruling machine is done with, it may all be disengaged from the press in a few minutes; by drawing back the pivot holes, which are made to screw in and out for the purpose, in the board, on the near side, the slides will be detached; loosen the screws of the catch plate, take that and the board away, and nothing will be left to interfere with the working of the press.

J. H. Cary, Shepton Mallet.

An Owl "far, far at Sea!"—The ship *Margaret*, lately arrived from Quebec, brought home a prisoner of rather an extraordinary description—a fine owl, which was captured at sea, not less than five hundred miles from any land.

PROGRESS OF THE RAILWAY SYSTEM.

This may be termed the "Railroadian Era" in the world's eventful history. The grass will shortly be found growing in luxuriance and the brightest verdure, on the "Great North," or the "Western Roads," while the "long stages," the "Hirondelies," "Heroes," "Highflyers," and "Tartars," will soon only be thought of with as much contempt, and their placards, announcing that 220 miles could be performed in twenty hours, looked upon with as much curiosity as the announcement that the "York mail would be *four days* (God willing) in performing its journey to London." A year or two ago, we thought that if we could leave Manchester or Liverpool at ten o'clock, a. m., and arrive in London in time for breakfast next morning, we were doing tolerably well, and our friends on our departure did not fail to express their solicitude as to our *bon voyage*. But now, by making a little exertion, and rising an hour or two earlier, we can start to London in the morning, and arrive in the metropolis at an early hour in the afternoon of the same day, and no one ever thinks it worth while to wish us a safe arrival. We can seat ourselves as comfortably in a first-class carriage as in our own sitting-room, and if we choose to play the luxurious, can sleep all the way in "a bed-carriage," composing ourselves on our departure, and awaking to all the comforts of metropolitan fog, crowd, and confusion. But this change in the mode of transit has not been effected without the sacrifice of some interests—not without bringing great and crying evils—not without entailing upon us some abuses. A mighty movement has been made—an enormous stride has been taken by the giant—Intellect. Time is laughed at—distance is accounted nothing. The mere laying down a bar of iron, and the application of steam, have wrought the most wonderful change that has ever taken place among us. But will the result be beneficial, or will it not? The philosopher and the moralist may ponder upon the change - the theorist may speculate and lay down his wild fancies, and persuade thousands that they are based upon a firm foundation; and he may daily make converts, until one little touch of experience dissolves the dream away and shows all its fallacies. The thoughtful man may paint a picture of the future—he may do it in a masterly manner—but it may prove unlike. Railways, which were at first mere private speculations, have now become altogether national; immense sums have been embarked in their formation, and as they spread far and wide, they become monopolies, and are daily altering the face of our commercial, and, perhaps, social intercourse. Since, then, they have become thus powerful and national, it behoves the legislature to look closely after them, and to take care that the public welfare is not sacrificed to private or collective interests.—*Chester Gazette.*

ON METALS AND THEIR COMBINATIONS.

(*Continued from page* 100.)

Having in the first part explained the chief characteristic properties of metals, and their combination with each other, I shall now proceed with the combination of metals with non-metallic elements, namely, oxygen, chlorine, iodine, bromine, fluorine, sulphur, phosphorus, carbon, and hydrogen, and generally in more than one proportion; the resulting compounds are termed oxides, except where an acid is produced, as with arsenic, antimony, chromium, &c. The means by which they absorb oxygen, is termed oxidation; and the menstruums by which this is effected, are called oxidizing agents. Some of the metals become oxidized by mere exposure to air, but most of them require more powerful agents, such as nitric acid, or nitro-hydrochloric acid. The oxides thus formed may be reduced to the metallic state by deoxidizing agents. The oxides of gold, platinum, &c., are reduced by the mere agency of heat alone, while those of lead and tin, and many others, are reduced by means of heat and combustible matter; but the reduction of the oxides of barium, strontium, &c., are much more difficult, having only been effected by the agency of galvanism. Most of the metallic oxides are capable of combining with acids to form a class of compounds termed salts.

Chlorine has a great affinity for metals; so great in many cases, that the combination is accompanied with heat and light. The soluble chlorides decompose water when added to it, the oxygen of the water uniting with the metal, forming an oxide, while the hydrogen combines with the chlorine, forming hydrochloric acid; a hydrochlorate is therefore the result.

Iodine has a great affinity for metals, although much inferior to chlorine; its compounds are termed iodides. All the iodides are decomposed by chlorine, bromine, and strong sulphuric or nitric acids.

Bromine has a strong affinity for most

metals, forming compounds which are termed bromides. The action of bromine in some cases is very intense, being accompanied with heat and light in a similar manner to chlorine. The bromides are formed by the action of bromine on the metals themselves, or by adding hydrobromic acid to the oxides of the metals, and then evaporating the solution to dryness.

Fluorine appears to have a strong affinity for most of the metals, but its direct action on the pure metals is not at present known. The soluble fluorides are prepared by adding the carbonates to hydrofluoric acid, and evaporating to dryness. They are decomposed by the addition of strong sulphuric acid with the aid of heat; the presence of the fluoric acid which escapes is soon detected by its action on glass, which it instantly corrodes. Care should be taken that it does not escape in a large quantity, as it is sure to spoil almost everything around it. The affinity of sulphur for metals is also very great; it combines with them in many different ways. The combination may be effected in most cases by mixing the metal in small particles with sulphur, and exposing the mixture to heat, or they may be prepared by heating the sulphate of the oxide of a metal with charcoal. Most of the sulphurets may be prepared in a hydrated state, by passing a stream of sulphuretted hydrogen gas through a solution of any soluble salt of a metal. The salts of uranium, iron, manganese, cobalt, and nickel, are exceptions to it, but these are precipitated by sulphuret of potassium. A great many of the sulphurets are found native, and those of iron, lead, and antimony in great abundance.

Phosphorus is also capable of combining with metals, forming a class of compounds which are termed phosphurets. They may be prepared by bringing phosphorus in contact with metals at a high temperature; some of them are prepared by heating metals in contact with phosphoric acid and charcoal. Carbon unites with the metals, forming carburets. The only carburets of importance are those of iron. Plumbago (black-lead), cast iron, and steel, are all carburets of iron. Hydrogen combines with a few metals, to form what are termed hydurets. The only metals which possess this property, are zinc, potassium, arsenic, antimony, and tellurium.

A. Taylor.

WINTER MANAGEMENT OF THE DAHLIA.

We have more than once had occasion to speak of the cultivation of this splendid flower. The facility with which it is propagated, as well as the well-known beauty of the plant, must always render it a decided favourite. It now blooms the brightest gem in the parterre; and a more splendid, or a greater acquisition to any collection of plants, is not at present known in the annals of floriculture. To those, therefore, who admire the dahlia, any remarks calculated to promote its cultivation must prove acceptable. The object at present aimed at, however, is the preservation of the root in winter. As the roots of this plant are seriously injured, and not unfrequently killed, if they are once suffered to be affected by the frost; it becomes indispensably necessary that means be employed to prevent its ingress to the place in which they are kept, and at the same time to prevent the roots from shrivelling, and to protect the vital principle. To accomplish this, requires the exercise of care and skill on the part of the cultivator. The plan we adopt, though at variance with general practice, has never yet disappointed our expectations; it is as follows:—When the stems are destroyed by frost, they should be cut down and removed, but the roots should be left in the ground, as experience proves that the roots so disposed of, produce their flowers much earlier in the succeeding season than if they were taken up and preserved in a house. To prevent the frosts from injuring the roots, they should be covered all winter with coal-ashes, saw-dust, or dung, sufficiently thick to prevent the frost from incrustating the ground beneath. In order to prevent their becoming too bulky in the plant—a circumstance which follows this practice—all the shoots as they come up must be pruned off, except one or two, according to circumstances; and this pruning should be continued during their whole growth, so as to model them into any size or form that may be required. By adopting this plan, as we have just observed, excellent and very early flowers may be obtained—otherwise, it is of little consequence where they are kept during the winter, so that they be dry, and secured from frost.—*Weekly Paper.*

Blue Dahlia.—A correspondent of the *Dorset County Chronicle* says, that "It is probable a blue dahlia might be obtained, by innoculating the seed vessels of a white one with a little of the pollen of the *osteospermum ceruleum*, which is a native of the

Cape of Good Hope, and bears a blue flower. The osteospermum and the dahlia belong to the same natural order and sub-order of plants, *composiæ helianthcæ*, and the osteospermum is the only one of the sub-order that bears a blue flower. All innoculation of plants, as every botanist well knows, must, to be fruitful, be from those of the same natural order.

DARTS INSTRUCTIVE FORFEIT GAME.

A PRETTY contrivance for rendering youthful amusement not only harmless, but instructive and useful. The game consists of draw-papers, cards, and a key, or book of directions. The draw-papers are little slips, each containing a sentence, indicating a number, directing to one of the cards; but, to know the number meant by the sentence, will generally require a little exercise of thought, and nothing tends to cultivate the mind more than that which leads to thinking. The cards are thirty-two in number, with a picture and verse on each; and the key affords the list of forfeits, explains the draw-papers, &c.

The explanatory rhymes do not sufficiently resemble poetry to inculcate a vicious taste, and many of them contain interesting information in astronomy, natural philosophy, natural history, &c. Some of them are in praise of *tee-totalism*, a science of small pretensions in point of edification, but harmless, and even beneficial in its effects, if not indulged in to excess. We recommend the "Forfeit Game" as an agreeable and profitable diversion for our juvenile friends, and the approaching "merry Christmas," will, we trust, occasion a demand commensurate with the labour and cost which has been bestowed upon it.

THE CHEMIST.

ACIDS.

NO. X.

Phosphoric acid may be formed by burning phosphorus in excess of oxygen. There are intense heat and light produced, and white deliquescent flocculi line the interior of the receiver. It is produced in the same way by burning phosphorus under a dry bell glass in atmospheric air. For this purpose a piece of phosphorus in a watch-glass or small porcelain capsule, may be placed upon a plate of glass, and covered over with a tall receiver; when inflamed, it burns at first furiously, but the combustion gradually subsides for want of air, and may be renewed by gently lifting the receiver off the glass plate; thus the whole of the phosphorus may be gradually burned, and it forms a quantity of dense smoke, which subsides in the form of snowy flakes; this is anhydrous phosphoric acid. If a little water be dropped upon it, it dissolves with a hissing noise, and much heat is evolved; but it is some time before the whole dissolves into a clear liquid. It is also soluble in alcohol. Its salts are termed *phosphates*.

Molybdic Acid.—To obtain this acid, the native sulphuret of molybdenum should be triturated as far as possible to powder, and distilled with three or four parts of nitric acid to dryness. This operation should be repeated till the ore is converted into a uniformly white mass, which consists of molybdic, nitric, and sulphuric acids; the two latter may be expelled by a red heat in a platina crucible, and the remaining molybdic acid repeatedly washed with boiling water, in which it is little soluble, will be nearly pure. It may be rendered perfectly pure by solution in ammonia, precipitation by nitric acid, and exposure to heat. The molybdic acid thus procured is a white powder, of the specific gravity of 3.46, and requiring 960 parts of boiling water for its solution, which is yellow, reddens litmus, but has no sour taste. If heated to redness in an open vessel, it slowly sublimes, and condenses in brilliant yellowish scales. It dissolves in hot sulphuric acid, forming a solution which is colourless while hot, but on cooling acquires a blue colour. Its salts are termed *molybdates*.

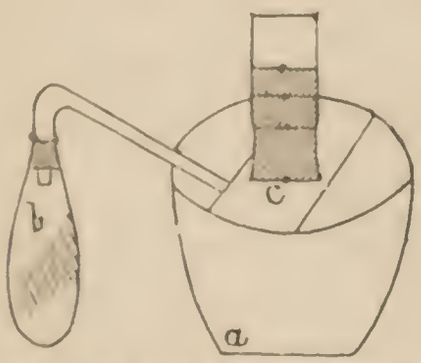
Purpuric acid may be obtained as follows:—Dissolve *pure* uric acid in diluted nitric acid, and saturate the excess of nitric acid in the solution by ammonia, then evaporate slowly, and red crystals will be separated, consisting of purpurate of ammonia; digest these in liquid potassa till the red colour disappears, then add sulphuric acid in quantity to saturate the potassa, the purpuric acid remains in the form of a yellowish powder without smell or taste, and nearly insoluble in water, alcohol, and ether, but soluble in the concentrated mineral acids. It contains metallic oxides, and expels carbonic acid from the alkaline carbonates, by the assistance of heat. With bases it forms salts termed *purpurates*.

Saccholactic Acid.—When sugar of milk is treated with nitric acid, it affords a peculiar acid similar to mucic acid obtained from gum. To procure this acid, one part of powdered gum-arabic may be digested

in two of nitric acid in a moderate heat; as soon as effervescence commences, set the flask in a cool place, and a quantity of white powder subsides, which is to be collected upon a filter, digested in dilute nitric acid to separate oxalate of lime, and subsequently purified by boiling water, which deposits the mucic or saccholactic acid on cooling. If sugar of milk be used instead of gum, it is obtained pure by the first operation. This acid is not crystallizable, and is sparingly soluble in water, requiring 60 parts at 212°, and is deposited as the solution cools. It combines with the metallic oxides, and forms a class of salts termed *saccholactates*.

Sêlenious Acid.—When a current of oxygen gas is passed over selenium, heated to its boiling point, it burns with a pale bluish green flame, and this acid sublimes and condenses in long brilliant prismatic crystals, provided the vessel into which it is received is cold and capacious, otherwise the sublimate is semifused and transparent; this is dry selenious acid; it loses its transparency by exposure to air, and rapidly absorbs water. Exposed to heat, the water separates again before the acid rises in vapour. Its taste is sour and hot, its odour, when sublimed, acid. It is very soluble in warm water, and the solution furnishes crystals of the hydrated acid. It also dissolves in alcohol, and furnishes on distillation a liquid of an ethereal odour. If this alcoholic solution be mixed with sulphuric acid, and then distilled, the product has an odour so insupportable, that Berzelius was unable to proceed in its examination. It forms salts called *selenites*.

To make Oxygen Gas.—Put some black oxide of manganese into a flask, and pour over it as much sulphuric acid as will just wet it. Set it in a sand-bath and make the sand hot; or hang it over a candle By inserting a pipe through a cork, thrust into the neck, the gas may be collected in a bladder; but a much better way is by a pneumatic trough. To make this, take a



large basin, *a*; cut a piece of wood, *c*, half an inch thick, two or three inches broad, and rather shorter than the width of the basin so as to allow it to sink about an inch down. In the middle of the board bore a hole; and on the underside, as much lead as will cause it to sink in water. This being done, set it in the basin, and pour in as much water as will just cover it. Fill a vial with water, invert it, and set it over the hole. Cause a bent tube, proceeding from the flask, *b*, containing the manganese, to pass under the side of the board, so as to come exactly under the hole. As the gas comes over, it will rise into the vial, and displace the water. When nearly full, slide the vial to the side of the wood, and cork it. Leave a little water in to protect the bottom. Hot water must be poured upon the manganese directly, to prevent it from becoming solid, or the flask will be spoilt.

MISCELLANEA.

Novel Steam Apparatus.—The *Oxford Herald* gives the following description of an ingenious application of steam power, by which in the Oxford Union Workhouse, the whole of the clothing and other articles used in it are washed, dried, and ironed, in an almost incredibly short space of time. No less than 1,235 articles of apparel, bed-clothes, &c., were washed, dried, and ironed, in two days, with the assistance of only eight women, and two girls from the school. This unique and elegant machine is the invention of James Wapshare, Esq., of Bath, for which we understand he has obtained a patent. The apparatus consists of a small steam-boiler, with two pipes for the conveyance of steam. By the one pipe the steam is conducted to the coppers used for boiling the clothes, and supplying the washers with hot water; by the other the steam is carried to a closet, or large box, in which the linen is to be dried. The exterior of this box is a wooden frame, covered with zinc; within it is fitted up with pipes, increasing in number according to the extent of drying power required. These pipes are arranged horizontally, one above another, connected at one end by a bend or turn, thus forming a continued duct for the steam. The steam is admitted at the upper pipe, and passes its condensed water at the lowest. On either side of this tier of pipes is a moveable clothes horse, which is drawn out to be hung with clothes. These horses are made close at the top of the box, so that no heat may *escape over* them, and the clothes are so disposed on them, as to form an entire sheet, completely enclosing and preventing any escape of the heat radiating from the pipes, except *by passing through* the articles to be dried. This disposition of the clothes is easily to be accomplished, but difficult of description. On the outside of the horses, or on that side which has not the pipes, a valve or opening is made on the top of the box, and a current of air being admitted at the bottom, the steam or moist air derived from the clothes as they dry, is carried off as fast as it is generated. One set of these

pipes, with two horses, would be sufficient for any moderate family. In an establishment so extensive as a Union Poor House, more is required. In the closet or box erected are three ranges of pipes, and consequently six horses, or two to each range, having an air space, with its valves, between each set of horses. Attached to the flue that surrounds the boiler is a small oven for heating the irons, so that the whole operation of the laundry, as far as heat is required, is simultaneously effected by one fire.

Cedar Quarries.—On asking a friend from Oswego, the other day, who used this term, what it meant, he informed us, that much of the cedar which comes from Lake Ontario is absolutely dug out of the soil. On some of the islands in that lake, which furnish great quantities of that valuable timber, there has not been growing a single tree for many years. Generation has apparently succeeded generation of this timber, and fallen, and been successively covered with earth, and is dug out for railroads, fence posts, &c., in a perfectly sound state. The above is from the Cultivator Persons who have been on the island have stated to us similar facts. We believe, however, the quarries are getting exhausted of their most valuable mineral—the red cedar—or that it is so deeply imbedded, that the labour of excavation is not sufficiently rewarded. During this season, nearly all the cedar importations have been of a white species. We have heard it stated, that on some of the islands—the ducks and pigeons, for instance, at the north-eastern termination of the lake—have made subterranean passages pervading their whole area; that the roof or exterior surface seems to be composed of agglomerated earth matted and held together by roots of trees which rest upon it, and have covered it with a thick growth of timber. The vaulted passages or dens below are filled with cedar logs lying in every variety of position, and which no doubt formerly, like the rafters of a house, gave support to the superincumbent mass. From the accounts we have had, there are more wonderful labyrinths constructed by nature on Lake Ontario, than that of old upon the banks of Lake Mœris.—*Oswego Palladium.* [Similar quarries exist, or did exist, in the Jersey marshes, between this city and Newark. Within our own day, we have seen people engaged in excavations for fencing timber. Thus cedar posts and rails were dug from the earth on one side of Newark, and blocks of free stone on the other.—*New York Com Adv.*]

To make Impressions of Leaves upon Silk, Satin, Paper, or any other Substance.—Prepare two rubbers of wash-leather, made by tying up wool or any other substance, in wash leather; then prepare the colours which you wish the leaves to be, by rubbing up with cold-drawn linseed oil the colours you want, as indigo for blue, chrome for yellow, indigo and chrome for green, &c.: get a number of leaves of the size and kind you wish to stamp, then dip the rubbers into the paint, and rub them one over the other, so that you may have but a small quantity of the composition upon the rubbers; place a leaf upon one rubber and moisten it gently with the other; take the leaf off and apply it to the substance you wish stamped; upon the leaf place a piece of white paper, press gently, and there will be a beautiful impression of all the veins of the leaf. It will be as well if only one leaf be used one time. The leaves picked should be of one size, as the work will not look uniform. E.

Beginning of Road-making.—The infancy of road-making, like that of navigation, must be sought in the infancy of nations. A canoe, hollowed out of the trunk of a tree, was the beginning of ship-building; and an Indian's trail, by which an untutored tribe wend their way in single files, through forest or glassy glade of boundless extent, is the first germ of a road. Conveyance by a quadruped, which rendered necessary the widening of the trail into a sort of bridle-path, formed, most likely, the second step in the improvement of itineracy. Next came the use of carriages; a sledge, perhaps, first; after that the cart, or sledge, raised on two wheels, connected by an axle. Then came the double cart, or waggon of four wheels, by which two parallel and transverse axles were connected by a fixed longitudinal one. In principle, no improvement beyond this has been made in the construction of carriages, save that just alluded to, of the moveable joint, which at once, by the facilities it afforded for turning curved lines, dispensed with the necessity of rectilinear roads for large vehicles.—*Wade's British History.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 12, G. A. F. Wilks, M. D., Lecturer at the North London and Westminster Hospital Schools of Medicine, on Botany. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Dec. 13, Mr. James Burton, on the Applications of Chemistry and Machinery. At half-past eight.

QUERIES.

Where can I obtain a model of a steam-engine and sugar mill, with boiling apparatus, such as are sent to the West Indies? R. H.

How to make Circassian cream? Also, how to solder copper and zinc plates together for galvanic purposes? A SUBSCRIBER.

In what way are the masks made which they use at the theatres, consisting of noses, foreheads, faces, &c.? They seem to be made of paper, if so, how are they moulded, and which is the best way of making them? J. S.

Could any of your numerous correspondents give me the receipt of the varnish used on cartoons for peaks of caps, and also for cambric or lawn? I have tried the receipts given in Vol. I., but they do not answer, they either run or are not a good black. OLIVER.

How to clean and polish shells?

CRAPPEY.

1. How many cubic feet of gas are required to raise 100 lbs. 100 feet high? 2. How to make a magnetic needle for a compass? 3. How to make small leaden pipes? 4. How to make differently coloured stains for paper? 5. How to mix the colours for stencilling? 6. How to make the Drummond light? 7. How to polish glass? 8. How to transfer copies of prints on to wood blocks for cutting? 9. How to stain Cypress paper? 10. The construction of the Bude light? 11. Which is the lightest, silk or bladder, for a small balloon? H. D. CHARD.

ANSWER TO QUERY.

Sir,—"B. C.'s" question can be solved by the Rule of *Position* in simple arithmetic:—If 12 quarts of wine be taken out of a wine tub, and 12 quarts of water be poured into it; if this operation be repeated four times, and if there then remain 51 quarts of pure wine in the tub, what was the original quantity contained therein?'

Suppose that 100 was the original number of quarts of wine in the tub;—

	Quarts		Wine.		Water.
Then from	100				
Take	12				
	88				
Add of water	12				
	100	=	88.	+	12
From this mixture take....	12				
	88	=	77.44	+	10.56
Add water	12				
	100	=	77.44	+	22.56
From the mixture take....	12				
	88	=	68.1472	+	19.8528
Add water	12				
	100	=	68.1472	+	31.8528
Again take	12				
	88	=	59.969536	+	28.030464
Add water	12				
	100	=	59.969536	+	40.030464
Take (fifth time)	12				
	88	=	52.77319168	+	35.22680832
Add water	12				
	100	=	52.77319168	+	47.22680832

The 100 quarts of mixture finally consisting of { Wine .... 52.77319168 / Water 47.22680832

Then by the following proportion:—

Remaining. Original. Remain. Original.
52.77319168 : 100 :: 51 : 102.324;

Thus giving 102.324 quarts as the original quantity of wine contained in the tub.

To find the quantity of wine remaining after taking from the mixture 12 quarts, say as the 100 quarts of the mixture : wine contained in it :: the remaining 88 quarts : wine contained in it,

100 : 88 :: 88 : 77.4;

and in the same way with the others following.

T. S. R.

TO CORRESPONDENTS.

A Cosmopolite *will find his query answered in a forthcoming article on lithography.*

A Constant Purchaser *will also find a description of the solar microscope, the optical construction of which is similar to that of the oxyhydrogen microscope, at the Adelaide Gallery.*

W. J. N.—*We will refer to the work he mentions, and shall then be able to explain the difficulty.*

A Subscriber.—*Copper and zinc may be soldered by the application of acid to the surfaces required to be joined—sulphuric acid, we believe, is usually employed.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 65 & 66, NEW SERIES. | SATURDAY, DEC. 14, 1839. (PRICE TWO PENCE.) | Nos. 186 & 187, OLD SERIES.

CHARD'S COLUMNAR DIAL.

FIG. 1.

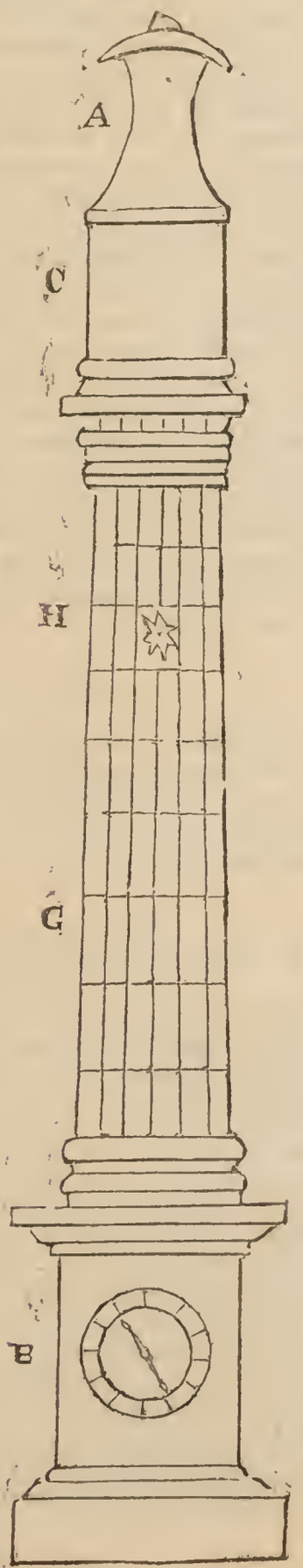
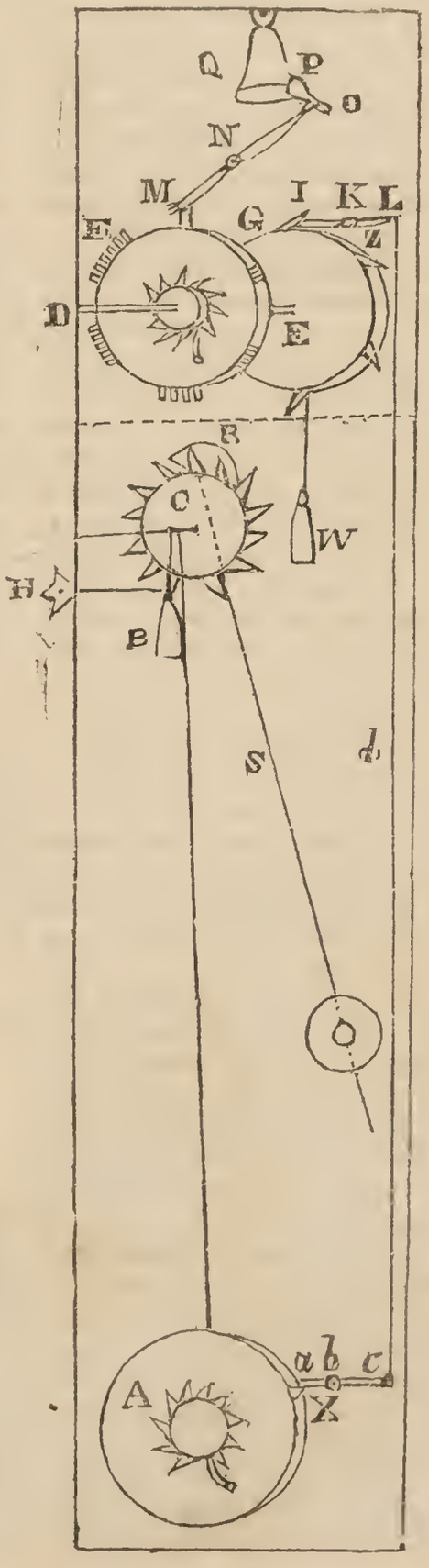


FIG. 2.



VOL. V.—Nos. 16 & 17.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

CHARD'S COLUMNAR DIAL.

(See Engravings, front page.)

Fig. 1, represents a column, or obelisk, A B, whose shaft, G H, is fluted, and divided by horizontal lines, that appear as joints, and serve to mark the hours. The inside of this column is hollow, as is represented by fig. 2; in the inside of the column is placed the movement, which is kept in motion by the weight, B, fastened to a string that is turned twice round the spindle of the escapement wheel, C, and to this string is likewise fastened the index, H, which, as the weight descends, points to the hours marked on the outside of the column, as is shown in fig. 1, at H. The axis of the wheel, A, comes through the front of the column, and to the end of it is fixed an index that points to the minutes of each hour, marked on a circle in the front of the base, as in fig. 1, at B.

The striking part of this dial is in the capital of the column (see fig. 2), where D E is an axis, on which are placed the two wheels, F and G, of equal diameters. On the circumference of the wheel, G, are six teeth, placed at equal distances from each other. These teeth are taken by the detent or lever, I K L. The wheel, F, is likewise divided into six equal parts, in each of which is placed a different number of teeth from one to six. The short end of the detent or lever, M N O, takes the teeth of this wheel, and to the other end of it is fixed the hammer, P, that strikes the bell, Q.

The wheel, A, making a complete revolution every hour; when it comes to X, its tooth raises the end, *a*, of the lever, *a b c*, consequently depresses the opposite end, *c*, which by means of the string, *c d*, raises the end, I, of the lever, I K L, and the wheel, G, is turned by the weight, W, from G to Z.

The wheel, F, being of the same dimension as G, and fixed on the same axis, must move the same space, in order to which it must push up the end of the lever, M N O, that presses against one of its teeth, and that end descending again immediately, being heavier than the other, the hammer, O, will strike the bell; it will, in like manner, be forced over and fall between each tooth, till it comes to the end of the division, and consequently give as many strokes on the bell as there are teeth in that division. As the end, N O, of the lever, M N O, is three times as long as M N, while the short end is pushed over one of the teeth, the other will be pushed three times as far from the bell. The escapement wheel, C, must have sixty teeth for the detent, R, to fall into, that is fixed at the top of the pendulum, S, which must be long enough to beat seconds, which regulates the works of the dial. To the axis of each of the wheels, A and F, is fixed a racket wheel and a ketch, by which they are wound up.

It is evident from the construction of this dial, that it strikes from one to six only. It may be made to strike all the twelve hours, but then the number of teeth on the wheel, F, must be increased from 21 to 78, and consequently the wheels must be larger or the teeth smaller, either of which would be inconvenient. It would certainly be more eligible for clocks in general, to sound no more hours than six, as they would be less complex in their construction, the hours would be more readily told, and less liable to be mistook; nor would it be attended with any inconvenience, as it is impossible for anyone, to whom time is of the least importance, not to distinguish morning, noon, and night from each other.

P.S. A clock of this sort may be constructed at a small expense, and will make an elegant piece of furniture; or if elegance be not regarded, the machinery may be placed in the corner of a room, with a plain board before, and it will answer the intention equally as well. It is easy to conceive, that with a small alteration this machine may serve as a reveilleur or alarm.

H. D. Chard.

[Every practical man will perceive, that this construction is imperfect in several respects; we nevertheless insert it, as an ingenious hint which may possibly lead to something useful. – Ed.]

ON A NEW CALORIMETER,

By which the Heat disengaged in Combustion may be exactly Measured, with some Introductory Remarks upon the Nature of different Coals, by Andrew Ure, M.D.

[Read before the British Association.]

In these researches, which are still in progress, the first point which I seek to ascertain, is the proportion of volatile and fixed matter afforded by any kind of fuel, as, for example, pit-coal—when a given weight of it is subjected, in a retort or covered crucible, to a bright-red heat. The result of this experiment shows how far the coal is a flaming or gas coal, and what quantity of coke it can produce. The second preliminary point of importance

which I determine with regard to coals, is the amount of sulphur they may contain; a circumstance which has not hitherto been made the subject of precise investigation, in this country at least, but which is of great consequence, not only as to their domestic use, but to their employment by the iron-master and the manufacturer of gas. That good iron cannot be made with a sulphureous coal, however carefully coked, has been proved in France by a very costly experience. In general, when a coal leaves 15 or 16 per cent. of ferruginous ashes, we may conclude with certainty that it contains sulphur in corresponding proportion; for this substance exists always, I believe, in pit-coal, in the form of pyrites, but often disseminated or combined, so as to be invisible, unless by microscopic means. The most ready and exact method of determining rigidly the quantity of sulphur in any compound, is to mix a given weight of it with a certain weight of carbonate of potassa, nitre, and common salt, each chemically pure, and to ignite the mixture in a platinum crucible. A whitish mass is obtained, in which all the sulphur has been converted into sulphate of potassa. By ascertaining, with nitrate of baryta, the amount of sulphuric acid present, that of sulphur becomes known. By such a process, applied to different samples of coals, sent to me for analysis, I obtained the following results:—

Gas coals No.	1. Sulphur in 100 parts	3.00
	2	3.90
	3	2.42
	4	3.80
	5	2.50
	6	5.20
	7	3.40
	8	3.50

Coals for puddling cast iron to be converted into steel:—

	Spec. Grav.	
1, hard foliated, or splent	1.258	0.80
2, ditto	1.290	0.96
3, ditto	1.273	3.10
4, cubical, and rather soft	1.267	0.80

The presence of much sulphur in a gas coal is a great evil, because it affords, in its decomposition, so much sulphuretted hydrogen, as requires an operose process of washing or purification, which impoverishes the gas, and impairs its illuminating power by the abstraction of its olefiant gas or carburetted hydrogen. Hence I found, in a specimen of coal gas, as generated in the retorts of one of the London gas companies, no less than 18 per cent. of olefiant gas; but in the same gas, after its purification from sulphur, I found only 11 per cent. With a coal, such as No. 4 of the second series given above, at least 10 per cent. of the light might be economized. The apparatus which I employ consists of a large copper bath, capable of holding 100 gallons of water: it is traversed, forwards and backwards, four times, in four different levels, by a zig-zag horizontal flue, or flat pipe, nine inches broad and one inch deep, ending below in a round pipe, which passes through the bottom of the copper bath, and receives there into it the top of a small black-lead furnace. The interior furnace, which contains the fuel, is surrounded, at the distance of an inch, by another furnace, which case serves to prevent the dissipation of heat into the atmosphere. A pipe, from a pair of double-cylinder bellows, enters the ash-pit of the furnace at one side, and supplies a steady current of air to keep up the combustion, kindled at first by half an ounce of red-hot charcoal. So completely is the heat which is disengaged by the burning fuel absorbed by the water in the bath, that the air discharged at the top orifice has usually the same temperature as the atmosphere. In the experiments made with former water calorimeters, the combustion was maintained by the current of a chimney, open at bottom, which carried off at top a quantity of heat very difficult to estimate. My experiments have been directed hitherto chiefly to a comparison of the heating powers of Welsh anthracite, Llangennech, and a few other coals. I have found, that the anthracite, when burned in a peculiar way, with a certain small admixture of other coals, evolves a quantity of heat at least 35 per cent. greater than the Llangennech does, which latter is reckoned by many to be the best fuel for the purposes of steam navigation. One half pound of anthracite, burned in my apparatus, heats 600 pounds of water 10° Fahr., viz., from 62° to 72°, the temperature of the atmosphere being 66°; so that there is no fallacy occasioned either by the conducting powers of the surrounding medium, or by a chimney current. We thus see, that one pound of anthracite will communicate, to at least 12,000 times its weight of water, an elevation of temperature of 1°, by Fahrenheit's scale. For the sake of brevity, we may call this quantity, or energy, 12,000 unities of heat. One pound of Llangennech, in the same circumstances, will afford 9,000 unities: one pound of good charcoal, after ordinary exposure to the air, affords 10,560: perfectly anhydrous charcoal would yield much more: one pound of

Lambton's Wall's-end coals affords 7,000 unities. It deserves to be remarked, that a coal, which produces in its ignition much carburetted hydrogen and water, does not afford so much heat as a coal equally rich in carbon, but of a less hydrogenated nature, because, towards the production of the carburetted hydrogen and water, a great deal of latent or specific heat is required; indeed, the evaporation of unburnt volatile matter from ordinary flaming coals, abstracts unprofitably a very large portion of their heat, which they would otherwise afford. Hence, those chemists who, with M. Berthier and Mr. Richardson, estimate the calorific powers of coals by the quantity of carbon which they contain, or the quantity of oxygen which they consume, have arrived at very erroneous conclusions. The amount of error may be detected by experiments on the cokes of flaming coals. M. Berthier examines coals for their proportion of carbon, by igniting a mixture of each, finely pulverized, with litharge, in a crucible, and estimates 1 part of carbon for every 34 parts of lead which is reduced. I have made many researches in this way with both charcoal and anthracite, and have obtained very discordant results. In one experiment, 10 grains of pulverized anthracite, from Merthyr Tydfil, mixed with 500 grains of pure litharge, afforded 380 grains of metallic lead; in a second similar experiment, 10 grains of the very same anthracite afforded 450 grains of lead; in a third, 350 grains. In one experiment with good ordinary charcoal, fresh calcined, 10 grains mixed with 1,000 of litharge, afforded no less than 603 grains of metal. The crucible was, in each case, covered and luted. My future researches, which are intended to embrace every important variety of fuel, natural and artificial, will be made with an apparatus somewhat modified from that here described. Three furnaces will be inclosed within each other, with a stratum of air or ground charcoal between each, so as to prevent all loss of heat into the atmosphere, and thereby to transfer the whole heat disengaged by combustion into a large body of water, of a temperature so much below that of the atmosphere at the beginning of the experiment, as it shall be above it at the conclusion.

To Preserve Apples.—If apples are immersed in grain of any kind, they will keep good all the year round, and the grain will not in any way be the worse for it. This does not need any preparation or expense, as the apples may be put into a corn-bin or into a tub, and the corn intended for food for horses or poultry may be stored in this way.

THERMOMETER AND BAROMETER.

ITALY had the honour of inventing both the thermometer and barometer, the most important auxiliaries of modern science. Three different forms of thermometers, constructed for the *Academy del Cimento*, were copied and circulated over Europe. But the great object now was to procure an exact correspondence, by fixing on some standard scale. The Italians began the divisions at the cellar heat, supposing this to be uniform; and they marked other points by plunging the ball in certain chemical mixtures. Boyle proposed the freezing of the oil of aniseed for the lower point; and Halley recommended the ebullition of alcohol as the limit of the scale. The great advantage of deriving a point from the congelation of water was not at first perceived. Many observers believed it to vary under different circumstances, being deceived by the fact, that water will bear a greater cold before it shoots into crystals, though the temperature at which ice or snow begins to melt is always the same. Guericke was the first who started from the thawing point, in dividing the scale of a large spirit-of-wine thermometer. To regulate the divisions, two different ways occurred; either to assume a higher point, or to distinguish into small portions the capacity of the ball. The latter was the mode adopted by Newton, who recreated his mind with chemical experiments. Employing linseed oil, which expands largely, and bears a great heat, he subdivided the capacity of the glass into 10,000 equal parts; and, beginning from the point of thawing ice, he found the liquid to expand 256 at the heat of the human body, 725 at boiling water, and 1516 at melting tin; but preferring smaller numbers, he assumed 12 for blood heat, and reduced the other numbers in the same proportion to 34 and 71. This method was quite philosophical, but of very difficult execution. A correct and ingenious process for determining the scale of heat, was proposed in 1694 by Renaldini, a learned Italian mathematician. Taking the freezing and boiling of water for the extremes, he found the intermediate points from a mixture of ten parts, composed progressively of melting snow and water just ceased from ebullition, the ingredients being 1 and 9, and 8, 3 and 7, &c. About twenty years afterwards, Brook Taylor and Hauksbee applied that ingenious mode to ascertain whether the expansions of certain fluids are exactly proportional to the corresponding accessions of heat.

METHOD OF LAYING OFF THE MERIDIANS AND PARALLELS OF LATITUDE ON MAPS.

Draw a base line of any length, and in its centre erect a perpendicular bar, which divide into as many equal parts as there are to be degrees of latitude. Take a line equal to one of these degrees of latitude, and subdivide into 60 equal parts for minutes; then in the annexed table find the length of a degree of longitude on that parallel of latitude which is to pass through the top of the maps, and divide that line right and left of the central meridian into degrees of the length found in the table. Do the same with the parallel which is to pass through the bottom of the maps, and draw meridians from the degrees marked on the top to those marked on the bottom. Produce the central line, and any other two at equal distances on each side of it, till they meet in a point, from which as a centre describe the circular lines from one side of the map to the other, through the points marked on the central meridian. Number the degrees of each on both sides of the map, and subdivide them or not, as the size of the map will or will not allow. Instead of producing the central meridian and two others, and describing circular parallels of latitude, you may, if you please, draw straight lines through the same points parallel to the base, but this is not so accurate, though quite sufficient for many purposes.

Table showing the Lengths of a Degree of Longitude on the different Parallels of Latitude.

L.	Geo. Miles.	Lat.	G. Miles.	Lat.	G. Miles.	Lat.	G. Miles.	Lat.	G. Miles.
0	60.00	19	56.73	38	47.28	56	33.55	74	16.53
1	59.99	20	56.28	39	46.63	57	32.67	75	15.52
2	59.96	21	56.02	40	45.90	58	31.79	76	14.51
3	59.92	22	55.63	41	45.28	59	30.90	77	13.50
4	59.85	23	55.23	42	44.59	60	30.00	78	12.48
5	59.77	24	54.81	43	43.88	61	29.08	79	11.45
6	59.67	25	54.38	44	43.16	62	28.17	80	10.42
7	59.56	26	53.93	45	42.43	63	27.24	81	9.38
8	59.42	27	53.46	46	41.68	64	26.31	82	8.35
9	59.26	28	52.97	47	40.92	65	25.36	83	7.32
10	59.09	29	52.47	48	40.15	66	24.41	84	6.28
11	58.90	30	51.96	49	39.26	67	23.45	85	5.28
12	58.49	31	51.43	50	38.57	68	22.48	86	4.18
13	58.46	32	50.88	51	37.76	69	21.51	87	3.14
14	58.22	33	50.32	52	36.95	70	20.52	88	2 9
15	57.95	34	49.74	53	36.11	71	19.51	89	1.5
16	57.67	35	49.15	54	35.46	72	18.55	90	0.0
17	57.38	36	48.54	55	34.41	73	17.54		
18	57.06	37	47.92						

Discipulus.

[This table may be applied to the construction of balloons; instead of 360, which would be inconvenient, 60, 30, or 15, may be taken, and a perfect sphere will be produced by adhering to the above proportions, provided the number of gores be *four times the number of divisions from the equator to the pole.* Suppose, for instance, there are 60 gores, there must be 15 divisions from the equator, or broadest part, to the pole, and the numbers corresponding to every sixth degree of latitude, will indicate the proportional breadth. This will hold good with any other division, as 20 gores and a division of 5 on each side of the equator, &c.—Ed.]

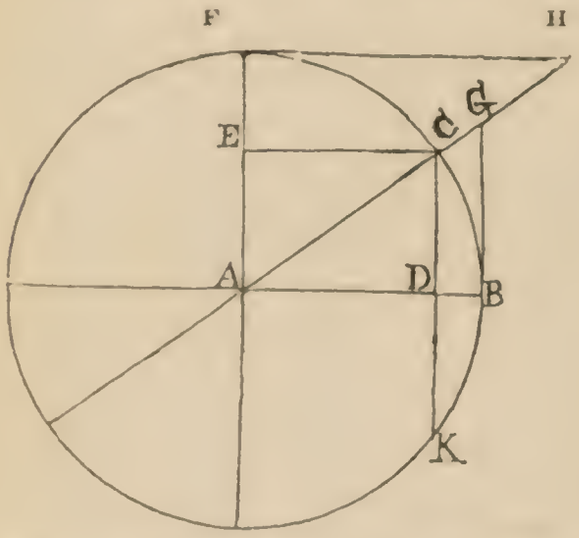
Method of Destroying Rats or Mice.—Mix flour of malt with some butter, and add thereto a drop or two of oil of aniseed; make it up into balls, and bait your trap therewith. If you have thousands, by this means you may take them all. The round trap with several holes is best, and it should be set in such places the vermin most frequent. But if you would take them without a trap, make up small balls of the above-mentioned composition, and add to every four ounces a quarter of an ounce of corrosive sublimate.—*Noble's Compendium.*

TRIGONOMETRY.

THE following concise account of the elements of trigonometry, comprising all the rules which are necessary for the solution of ordinary questions, is extracted from a little volume which we recommended to the notice of our readers in a former number, "A Treatise on a Box of Instruments, and the Slide Rule," by T. Kentish: –

"The circumference of a circle is supposed to be divided into 360 equal parts, called degrees. Each degree is divided into 60 minutes; each minute into 60 seconds; and so on.

Degrees are marked with a small ° at the top of the figure, minutes with ′, seconds with ″, and so on. Thus 36° 18′ 25″—36 degrees, 18 minutes, 25 seconds.



The difference of an arc from 90 degrees, or a quarter, is called its complement; thus F C is the complement of C B. The chord of an arc is a line drawn from one extremity of the arc to the other; thus C K is the chord of the arc C B K.

The sine of an arc is a line drawn from one extremity of the arc perpendicular to the diameter passing through the other extremity; thus C D is the sine of the arc C B, or angle C A B, which it measures; and C E is the sine of the arc C F, or angle C A F, which it measures.

The sine is half the chord of twice the arc, or angle.

The tangent of an arc is a line touching the circle in one extremity of the arc, and meeting a line drawn from the centre through the other extremity; thus G B is the tangent of the arc C B, or angle C A B; and F H is the tangent of the arc C F, or angle C A F.

The secant of an arc is the line meeting the tangent: thus G A is the secant of the arc C B, or angle C A B; and A H is the secant of the arc C F, or angle C A F.

The versed sine of an arc is the part of the diameter intercepted between the arc and its sine: thus D B is the versed sine of C B.

The cosine, cotangent, and cosecant of an arc, are the complement's sine, tangent, and secant; *co* being simply a contraction of *complement*. Thus C E, or A D, is the cosine of C B, being the sine of the complement C F: so F H is the cotangent of the arc C B, being the tangent of the complement F C; and A H is the cosecant of C B, being the secant of the complement C F.

From these definitions it is evident—

1st. That when the arc is 0, the sine and tangent are 0, but the secant is then the radius A B.

2d. When the arc is a quadrant, F B, then the sine is the greatest it can be, being the radius of the circle; and the tangent and secant are infinite.

3d. The versed sine and cosine together make up the radius.

4th. The radius A B, the tangent B G, and secant A G, form a right-angled triangle.

5th. The cosine A D, the sine D C, and radius A C, also form a right-angled triangle.

6th. The radius A F, the cotangent F H, and cosecant A H, also form a right-angled triangle. And since the angle F A H = the angle A C D = the angle A G B; and the angle F H A = the angle H A B, these right-angled triangles are similar to each other. Hence

A D	:	D C	::	A B	:	B G.	*i. e.*
cosine	:	sine	::	radius	:	tangent.	
A D	:	A C	::	A B	:	A G.	*i. e.*
cosine	:	radius	::	radius	:	secant.	
A E	:	E C	::	A F	:	F H.	*i. e.*
sine	:	cosine	::	radius	:	cotangent.	
E A	:	A C	::	F A	:	A. H.	*i. e.*
sine	:	radius	::	radius	:	cosecant.	

In every case in trigonometry, three parts must be given to find the other three, and one of these, at least, must be a side.

The cases in trigonometry are of three varieties;

1st. When a side and its opposite angle are given.

2d. When the two sides and the contained angle are given.

3d. When the three sides are given.

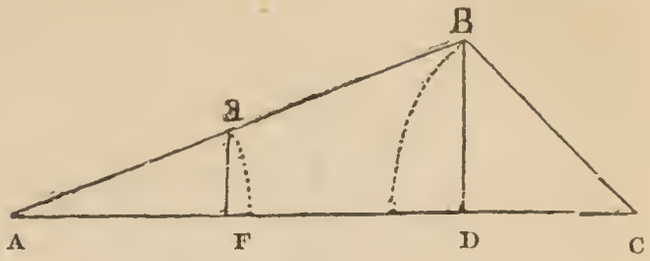
I.

When a side and its opposite angle are two of the given parts; then

Any side : sine of its opp. angle :: any other side : sine its opp. angle.

And,

Sine of any ∠ : its op. side :: sine any other ∠ : its opp. side.



Make A E = B C, and E F, B D, perpendicular to A C.

Then A B : B D :: A E : E F. But A E = B C;

∴ A B : B D :: B C : E F.

But B D is the sine of C, and E F of A;

∴ A B : sin. opp. ∠ C :: B C : sin. its opp. ∠ A.

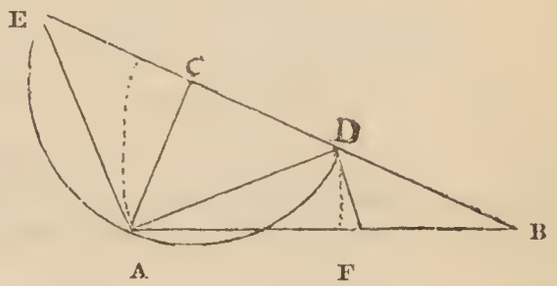
II.

When two sides and their contained angle are given.

Sum of sides : their difference :: tang. ½ sum of opposite angles : tang. of ½ their diff.

Then ½ sum + ½ diff. = greater;
and ½ sum − ½ diff. = less.

Let A B C be the proposed triangle, having the two given sides A C, B C, including the given angle C.



From C, with radius C A, describe a semicircle, meeting B C produced in D and E. Join A E, A D, and draw D F parallel to A E.

Then B E = B C + C A, the sum of the sides B C, C A: and B D = B C − C A their difference. Also,

$$\text{Also, } CAB + CBA = CAD + CDA = 2\,CDA;$$

$$\therefore \angle CDA = \tfrac{1}{2}\left\{CAB + CBA\right\}.$$

So C D A is half the sum of the unknown angles.

$$\text{Again, } \angle CDA = \angle DBA + \angle DAB;$$

$$\therefore \angle DAB = \angle CDA - \angle DBA$$

$$= \angle CDA - \angle CBA.$$

Add to each side D A B; then,

$$2\,DAB = CAD + DAB - CBA$$

$$= CAB - CBA;$$

$$\therefore DAB = \tfrac{1}{2}\left\{CAB - CBA\right\}.$$

So D A B is half the difference of the unknown angles.

Now E A D being a semicircle, E A is perpendicular to A D, as is also D F; ∴ A E is the tangent of C D A, and D F the tangent of D A B, to the same radius A D.

But, B E : B D :: A E : D F;

that is, the sum of the sides : difference of the sides :: tangent of ½ sum of opposite angles : tangent of ½ their difference.

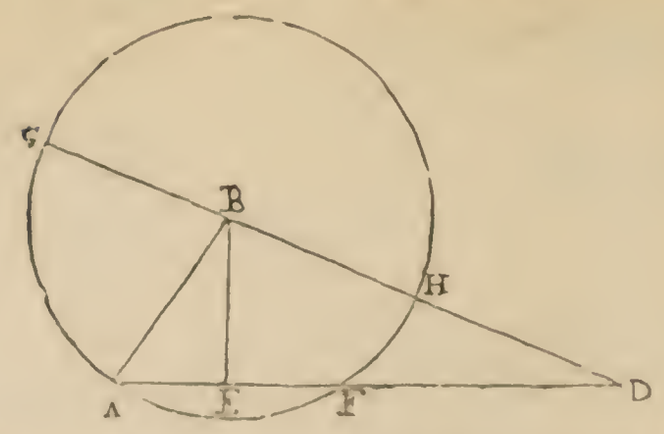
Three angles of a triangle being equal to 180°, the sum of the unknown angles is found by taking the given angle from 180°.

III.

When the three sides are given to find the angles.

Base : sum of other sides :: difference of those sides : difference of segments of base, made by perpendicular falling from the vertex.

Let A B D be the given triangle.



From B with the distance B A describe a circle, and produce D B to G. Then,

D G = D B + B A; and H D = D B — B A.

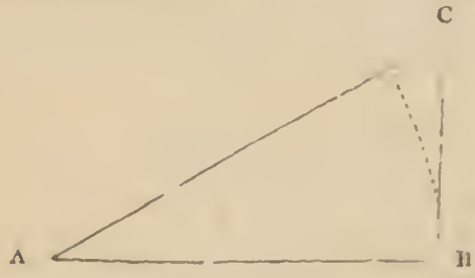
Also, since A E = E F; ∴ F D = D E — E A.

But A D : D G :: H D : F D; that is,

Base : sum of other sides :: diff. of those sides : diff. of segments of base.

Hence, in each of the two right-angled triangles, there will be known two sides, and the angle opposite to one of them.

All cases of plane triangles may be solved by these three problems; but for right-angled triangles, the following are more convenient:—



First make the base A B radius; then,

Radius : tang. A :: A B : B C; and

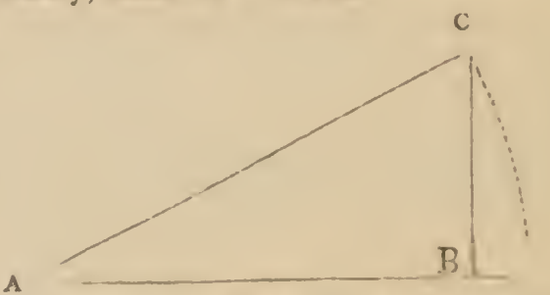
Radius : secant A :: A B : A C.

Next make C B radius.

Then Radius : tang. C :: C B : B A; and

Radius : secant C :: C B : C A.

Lastly, make A C radius.



Then Radius : sine A :: A C : C B; and

Radius : cos. A :: A C : A B.

THE NEW SYSTEM OF POSTAGE.

According to the old regulations, the charge for conveying letters from London or any other place, to a distance of 80 to 120 miles, was about 200*l.* per cwt., in addition to the charges for sorting, distributing, &c.—an enormous extortion, if we consider that the real expenses incurred in conveying a hundred weight of letters, is no more than would be charged for a hundred weight of wool, or of any other commodity of equal bulk. A transition from this state of things to the equitable charge of one penny (which the calculations of Mr. Rowland Hill, confirmed by a Committee of the House of Commons, have demonstrated to afford an ample remuneration to the Post-office establishment), is deemed by many too great a step to be suddenly taken, even in the path of improvement. It is, indeed, a rapid stride to pass from the old stagnant system, teeming as it was with inconsistencies and abuses, to one so nearly approximating to perfection, as almost to preclude the expectation and desire of farther improvement; but if we contemplate the gigantic achievements of science which so remarkably characterize the present age, unfolding the remotest secrets of nature, controling the elements, soaring above the

clouds, and exploring the depths of ocean —inanimate power whirling immense caravans with the swiftness of lightning to the uttermost corners of the kingdom, and a thousand other marvellous signs of irresistible progress and improvement in social organization, surely the abolition of the abuses and extortion of the Post-office, cannot be deemed a measure in advance of the civilization of the day.

We see, however, that the enemies of this measure are exulting in a temporary triumph, obtained by the introduction of that monstrous abortion, the four-penny postage, now in operation.

A close investigation of the unjust and absurd stipulations of this incongruous measure, creates a suspicion that they have been dictated by something worse than bonâ fide stupidity. The authors of the treasury minute "calculate" that four half-ounces make one ounce and an indefinable fraction; and a letter weighing the least perceptible quantity more than an ounce is accordingly charged four postages, although the same letter, separated into two, would be charged only three postages; by any division making one less than half an ounce, and the other less than an ounce—that is, eight-pence for the greater, and fourpence for the lesser, instead of 1s. 4d., which is exacted for the two combined. This, it must be owned, is consistent with the regulations of our public offices, where the salaries of the servants are always in an inverse proportion to the duties they are required to perform. It is also decreed, that in order to protract the time of delivery, pre-payment shall not be required for the great mass of general-post letters weighing less than an ounce; but for the sake of additional inconvenience and confusion, letters exceeding that weight are subjected to an extra charge if not pre-paid; and that extra charge is not, as might be supposed, a penny or twopence to compensate the labour and delay which are consequent upon collecting the money on delivery, but, in some cases, the exorbitant extortion of *ten shillings and eightpence*; and in all cases, double the amount which is demanded for pre-paid letters. There is another ingenious contrivance which deserves attention; if two letters or packets, each weighing four ounces and a quarter, be put into the letter box at the general post-office, and one directed to Windsor, and the other to Islington, the former will be delivered (the distance being 21 miles) upon payment of *twenty postages*, making the ominous sum of 6s. 8d., because it has been decided that four ounces and a quarter make ten half-ounces; and, therefore, the double of that, eight ounces and a half, must make twenty half-ounces; but the letter addressed to Islington (about two miles), *is not to be taken at all!—Quid multa?* We have asked for a fish, and they have given us a scorpion: but if we reject the scorpion, we do not lose sight of the fish, and (to quit the metaphor), if the people of this country continue to display the same energy and determination which they have hitherto done, WE WILL HAVE THE PENNY POSTAGE, in spite of the *bureaucracy* of St. Martin's-le-Grand, and the *chronicocracy* of another place.

THE CHEMIST.

ACIDS.

NO. XI.

Selenic Acid.—This acid is obtained by fusing selenium or selenious acid, or any of its salts, or a metallic seleniuret, with nitrate of potassa or of soda. Seleniuret of lead, as the most common ore containing it, has generally been used; it is to be digested in muriatic acid to separate carbonates, and the residue mixed with its weight of nitrate of potassa or soda, and gradually thrown into a red hot crucible; the fused mass is then well washed in hot water, which dissolves the alkaline seleniate and the nitrate. This solution, quickly boiled down, deposits seleniate of soda; this being separated, the nitrate crystallizes on cooling; the mother liquor again boiled, deposits more of the seleniate, and in this way the salts may be separated; for the seleniate, like sulphate of soda, is more soluble in water about 180°, than 212°. The seleniate of soda thus obtained, is not quite pure; it is to be mixed with muriate of ammonia, and heated nitrogen and water are evolved, selenium separated, and chloride of sodium formed. The selenium is now pure, and is to be converted by nitric, or nitro-muriatic acid, into selenious acid, neutralized with soda, and this converted into seleniate by fusion with nitre solution and crystallization as before. The solution of this pure seleniate is decomposed by nitrate of lead. The insoluble seleniate of lead is well washed and diffused through water, into which a current of sulphuretted hydrogen is passed to precipitate the lead; the liquid is boiled to evaporate excess of sulphuretted hydrogen, and is now dilute selenic acid; is a colourless liquid, which may be heated to about 536° without decomposi-

tion; it is partially changed at higher temperatures, and at 554° is rapidly resolved into selenious acid and oxygen; when concentrated by exposure to a temperature of about 360°, it acquires a specific gravity of 2.524, at 513° it is 2.600. Selenic acid has a strong attraction for water, and evolves much heat when mixed with it. When boiled with muriatic acid, selenious acid and chlorine are produced, so that the selenio-muriatic acid dissolves gold on the same principle as the nitro-muriatic. Its combinations are termed *seleniates*.

Succinic acid is obtained from amber by distillation. To obtain this acid in the largest quantity, M. Julien recommends coarsely powdering the amber, and mixing with it, previous to distillation, one twelfth part of sulphuric acid, diluted with an equal weight of water; about twice as much acid, he says, will be thus produced as when the amber is heated alone. When purified by repeated solutions and crystallizations, succinic acid possesses the following properties:—It forms yellowish prismatic crystals, soluble in twenty-four parts of water at 60°; very soluble in alcohol, and of a slightly acid and nauseous taste; it is fusible and volatile when heated, but not without partial decomposition; ten pounds of amber yield about three ounces of purified succinic acid. The perfect purification of succinic acid is attended with some difficulty. Richter recommends the saturation of the sublimate with potassa, and ebullition with powdered charcoal; the solution is then filtered, and nitrate of lead added. The resulting insoluble succinate of lead is decomposed by the requisite addition of dilute sulphuric acid, and the solution of pure succinic acid thus obtained being carefully evaporated, affords colourless prismatic crystals of the pure acid. Its salts are called *succinates*.

Sulphuric Acid. This body was formerly obtained by the distillation of green vitriol, and was called oil of vitriol. It is now procured in this country by burning a mixture of about eight parts of sulphur and one of nitre, in close leaden chambers containing water, by which the fumes produced are absorbed, and by evaporation the acid is produced in a more concentrated state. This improved method of preparing sulphuric acid was invented by Dr. Roebuck about the year 1746. Sulphuric acid, as usually met with, is a limpid colourless fluid, having a specific gravity of 1.800 to 1.810; it boils at 620°, and freezes at 15°, contracting at the same time considerably in its dimensions. But the temperature at which the diluted acid congeals, is singularly modified by the quantity of water which it contains. At the specific gravity of 1.780, it freezes at about 48°, but if the density be either increased or diminished, a greater cold is required for its congelation. Its boiling point diminishes with its dilution, and of the specific gravity of 1.780, boils at 535°; and acid of the specific gravity of 1.650, boils at 350°. It is acrid and caustic, and when diluted with water, produces a very sour liquid. It rapidly absorbs water from the atmosphere, so that in moist weather, three parts by weight increase to four in twenty-four hours. By exposure for a year, one ounce of acid acquired an increase of 6.25. Upon sudden mixture of sulphuric acid with water, condensation ensues, and much heat is evolved. Four parts of acid and one of water produce, when suddenly mixed, a temperature of 300°. According to Dr. Ure, the greatest heat is evolved by mixing 73 of acid with 27 of water. It clears animal and vegetable substances. The formation of sulphuric acid by the combustion of sulphur and nitre, is as follows:—The sulphur, by burning in contact with atmospheric air, forms sulphurous acid. The nitre gives rise to the production of nitric oxide, which, with the oxygen of the air, produces nitrous acid gas. When these gases (i. e., sulphurous and nitrous acids) are *perfectly dry*, they do not act upon each other, but moisture being present in small quantity, they form a white solid, which is constantly decomposed when put into water. The nitrous acid reverts to the state of nitric oxide, having transferred one additional proportion of oxygen to the sulphurous acid, producing the sulphuric acid, while the nitric oxide, by the action of the air, again affords nitrous acid, which plays the same part as before. The decomposition of sulphuric acid may be effected by passing it through a red-hot platinum tube, when it is resolved into sulphurous acid, oxygen, and water. Sulphuric acid is largely consumed in a variety of manufactures. It is used by the makers of nitric, hydrochloric, citric, and tartaric acids, by bleachers, dyers, tin-plate makers, brass-founders, and gilders. For these purposes it is generally sufficiently pure as it comes from the wholesale manufacturer; but as traces of lead, lime, iron, and potassa, are often found in it, it requires to be purified by distillation for the use of the experimental chemist. The distillation of this acid in glass retorts requires some precaution, in consequence of the violent jerks which the production

of its vapour occasions, and which often breaks the vessel; this may be prevented by putting some strips of platinum into the acid. It then boils quietly, and it is only necessary to take care that the neck of the retort and receiver are not broken, in consequence of the high temperature of the condensing acid. Dr. Ure has the following remarks on the distillation of this acid:—"I take a plain glass retort, holding from two to four quarts of water, and put into it about a pint measure of the sulphuric acid (and a few fragments of glass), connecting the retort with a large globular receiver by means of a glass tube four feet long, and from one to two inches in diameter. The tube fits very loosely at both ends. The retort is placed over a charcoal fire, and the flame is made to play gently on its bottom. When the acid begins to boil smartly, sudden explosions of dense vapour rush forth from time to time, which would infallibly break small vessels. Here, however, these expansions are safely permitted by the large capacity of the retort and receiver, as well as by the easy communication with the air at both ends of the adapted tube. Should the retort, indeed, be exposed to a great intensity of flame, the vapour will no doubt be generated with incoercible rapidity, and break the apparatus. But this accident can proceed only from gross imprudence. It resembles in suddenness the explosion of gunpowder. I have ascertained, that the specific caloric of the vapour of sulphuric acid is very small, and hence the damage to which rash operators may be exposed. Hence also it is unnecessary to surround the receiver with cold water, as when alcohol and most other liquids are distilled. Indeed the application of cold to the bottom of the receiver, generally causes it in the present operation to crack. By the above method I have made the concentrated sulphuric acid flow over in a continuous slender stream, without the globe becoming sensibly hot." When sulphuric acid was procured by the distillation of green vitriol, it was frequently observed that a portion concreted into a white mass of radiated crystals. It has been called *glacial* or *fuming-sulphuric acid*, and is considered to be the pure or anhydrous acid. The liquid acid from sulphate of iron, yields about one-fourth of its weight of anhydrous acid by distillation; but if this cannot be procured, the anhydrous acid may be obtained, according to Berzelius, by the distillation of such other sulphates as part easily with their acid. Bisulphate of soda, or persulphate of iron, may then be employed. The former may be made by mixing in a crucible three parts of thoroughly exuceated sulphate of soda, with two of common sulphuric acid, and heating them till the ebullition occasioned by the escape of water has ceased. The resulting dry mass is then to be pulverized, transferred to a porcelain retort, and distilled at a red heat; the acid which passes over may be collected in a receiver, cooled by ice. It is generally of a dark colour, which appears to arise from dust accidentally present. A persulphate of iron, applicable to the same purpose, may be made by mixing finely-powdered peroxide of iron into a thin paste with common sulphuric acid, and gradually heating it (below redness) till they combine into a saline mass, which is to be powdered and subjected to distillation as before. The acid thus obtained, generally contains a little water, and if it crystallizes, it forms brittle foliaceous crystals; carefully distilled with a gentle heat, the anhydrous acid passes over, and common liquid acid (hydrated) remains in the retort. The salts of sulphuric acid are called *sulphates*.

Sulphurous Acid is a gaseous body, which may be obtained by several processes. It may be procured directly by burning sulphur in oxygen gas, or indirectly, by boiling two parts of mercury in three of sulphuric acid; or by heating in a small glass retort a mixture of equal parts of black oxide of manganese and sulphur. It must be collected and preserved over mercury, for water takes up rather more than thirty parts of this gas. This aqueous solution when recently prepared, has a sulphurous astringent taste, and destroys many vegetable colours; but by keeping, it acquires a sour flavour, and reddens the generality of vegetable blues. Upon some colouring matters, as that of cochineal, it has scarcely any action, and when it does destroy colour, the original tint may often be restored by a stronger acid. A red rose, for instance, is bleached by dipping into a solution of sulphurous acid, but the colour is restored by immersion in dilute sulphuric acid. Sulphurous acid escapes when its aqueous solution is boiled, but not when it is frozen. Its specific gravity at 60° is 605. Alcohol dissolves sulphurous acid more copiously than water, one volume taking up more than one hundred of the gas. Monge and Clouet found, that at the freezing point and under pressure, sulphurous acid assumed a liquid form, and the experiments of Mr. Faraday place the pressure required for this purpose at two

atmospheres. M. Bussy has shown, that this acid may be obtained in the liquid form at common atmospheric pressure, by passing it through tubes surrounded by a freezing mixture of salt and snow. Its specific gravity is about 1.45, and it boils at 146°. In this state it evaporates with such rapidity at common temperatures, as to generate a great degree of cold. By its aid, mercury may easily be frozen, and it produces cold enough to liquify chlorine, ammonia, and cyanogen. Its salts are termed *sulphites*.

J. Mitchell.

THE ELEMENTS AND THEIR COMBINATIONS.

All bodies in nature are divided by the chemist into simple and compound. Of simple bodies, or elements, there are at present known 55 (including the new metal Lantane recently discovered by Dr. Hermann Meyer, of Berlin); these, by their various combinations, form all substances which have hitherto fallen under the observation of man. Few of them are ever found in a natural state uncombined, and many, when obtained separate, are preserved so with difficulty, owing to the tendency which they have to combine with other matter and form compounds, which take the part of elements, and again combine in endless variety. Of the fifty-five simple substances termed elements, there are five which, at common temperatures, are in the gaseous and invisible state; these are oxygen, hydrogen, nitrogen, chlorine, and fluorine; as these are the most important, I shall describe them first,—two are in the liquid state—mercury and bromine, and the remainder are solid, and exist in the forms of powders, masses, &c.; they are forty-eight in number, viz,

Aluminum	Iridium
Antimony	Iron
Arsenic	Lantane
Barium	Lead
Boron	Lithium
Bismuth	Magnesium
Cadmium	Manganese
Calcium	Molybdenum
Carbon	Nickel
Cerium	Osmium
Chromium	Palladium
Cobalt	Phosphorus
Columbium	Platinum
Copper	Potassium
Glucium	Rhodium
Gold	Selenium
Iodine	Silicium
Silver	Titanium
Sodium	Tungsten
Strontium	Vanadium
Sulphur	Uranium
Tellurium	Yttrium
Thorium	Zinc
Tin	Zirconium.

Before, however, proceeding to describe them separately, it may be as well to give an outline of the terms applied to like compounds:—Potassium, sodium, lithium, combine with oxygen to form the alkalies. Potassa, soda, lithia, oxygen, also combine with aluminum, barium, calcium, strontium, glucium, silicium, thorium, yttrium, and zirconium, all of which, when heated in the air, absorb oxygen and form earths.

Oxygen.—This elementary gaseous body was discovered by Dr. Priestly on the 1st of August, 1774, who gave it the name of *dephlogistic air*. In the following year Scheele also discovered it, without any knowledge of the previous experiments of Priestly, and named it *empyreal air*; it has also been called *vital air*. It is obtained in the purest state from chlorate of potassa, but it may be obtained much cheaper from the black oxide of manganese. A pound should yield from forty to fifty pint measures of the gas. It is obtained from the oxide as follows:—Put the oxide into an iron gas bottle, which may be about four-fifths filled with it, and placed with a proper connecting tube in a proper furnace or fire place. When the bottle containing the oxide becomes red-hot, the gas begins to pass off by the tube which must be bent so as to pass under the trough of the water apparatus. It may also be obtained by mixing the oxide and sulphuric acid in such proportions as to be about the thickness of cream; this mixture is to be put into a glass retort, and heated over an Argand lamp, and the gas collected by means of the pneumatic apparatus. Oxygen gas is insipid, inodorous, and colourless; it is permanently elastic under all known temperatures and pressures. Its specific gravity, as compared with air, is as 1.211 to 1.000. Its equivalent number is 8. It is absorbed in very small quantity only by water; it does not alter the colour of litmus, nor does it render lime-water turbid. It is a powerful supporter of respiration. An animal will live in it a considerable time longer than in the same quantity of atmospheric air, but its respiration becomes hurried and laborious, and it falls a sacrifice to excess of arterial action. A lighted taper introduced into this gas is very rapidly consumed with intense ignition and

enlargement of the flame. If an iron wire be introduced into a bottle of oxygen with a piece of lighted charcoal at the end of it, it will burn with a bright light, and throw off vivid sparks, and partly fuses into globules of oxide of iron. Sulphur burns in it with a dark purple flame. Phosphorus, when inflamed in oxygen, burns with such a bright light, that the eye can scarcely bear its brilliancy. A piece not larger than a pea should be used in this experiment. In all these cases of combustion in oxygen gas, the sudden expansions which take place are apt to endanger the jar, which should therefore be held by the hand, so as to allow of a little occasional escape of the gas. It is more abundantly diffused through nature than any of the other elementary bodies. It forms eight-ninths of the weight of water, about one-fifth the weight of the atmosphere, and a large relative proportion of the earthy and mineral bodies which form the solid matter of the globe. It also forms, with scarcely one exception, an element of the various products of organized bodies, both in the animal and vegetable creation.

J. Mitchell.

MISCELLANEA.

To make Boots and Shoes waterproof.—Instruct the shoemaker, when he is making your shoes or boots, to put a piece of lard bladder, the whole size of the under sole immediately upon it, before the wealting is sown on: and this will prevent any damp penetrating.

To destroy Fleas and Bugs.—After thoroughly washing your bedstead and room, mix well together strong vinegar and salt, and wet the floor of your room and the bedstead, particularly the crevices and joints, several times with it, and it destroys both fleas and bugs.

Eclipses of the Sun and Moon.—In the year 1840 there will be two eclipses of the sun and moon—all invisible in this country. The eclipses of the sun are on the 4th of March and 27th of August. The first is annular, and visible to the whole of Asia; the second is total, and visible to part of Africa and the Indian Ocean. Those of the moon occur on the 17th of February, and on the 13th of August. They are both partial—the magnitude of the first being .362 on the southern limb, and the second .607 on the northern limb, the diameter of the moon being reckoned equal to 1.

Eggs of Flies.—It appears to be a principle in nature, that those animals which are most useless to mankind, or most destructive, produce fewest young. This holds with regard to insects, among whose tribes some lay only two, while others lay many thousands of eggs. One of the most useful flies is the blow or flesh fly, which lays its eggs in dead carcasses, and from which maggots are brought forth. Flies of this kind have been opened, and they have been found on minute inspection by means of the microscope, to contain twenty thousand eggs. Indeed the whole of the bulky part of these flies seems to be composed of nothing but eggs, which do not lie in a confused mass, but are rolled up like the spring of a watch, and ready to be projected on the tainted substance.—*The Naturalist.*

Breathing Apparatus of Maggots.—These insects breathe through their tails, which resemble small threads, and stick out above the surface of the miry matter in which they are suspended. This is the case as to some kinds of maggots; the breathing tube of one of which the following is a description:—The breathing apparatus consists of two tubes, one within the other, the inner or smaller being projected or drawn in through the larger, like the tubes of a spy-glass. These tubes may be pushed to an extent of twelve times the length of the body of the maggot. Long as this tail is, both the outer and inner tube which compose it, are formed of nicely-jointed fibrous rings, capable of being extended or drawn in almost instantaneously. When drawn in, the inner tube is coiled up in such a way as to be again easily forced out by the inflation of air from the windpipe.—*Ibid.*

The Mason Bee.—One good old lady took up her position within a foot of the sofa on which I was accustomed to lounge during the extreme heat of the day. I therefore could watch all her motions without any trouble. I copy here the memorandum made at the time:—"House completely built in about three hours; diameter of the foundation-circle 6-8ths of an inch, height when completed, 5-8ths, and door or chimney projecting scarcely 1-8th. I could not decide whether more than one bee was occupied in the construction, because they are so much alike; but there never have two appeared at the same time." When the building was finished, it was left for the remainder of the day to consolidate, and it soon became hard and dry. Next morning, as soon as the sun was up, I found the labourer of the preceding day arrive, and in her arms a long slender green caterpillar. She approached the open door or chimney, but did not risk on it; for while hovering on the wing, she contrived to push the head of the caterpillar into the hole, and then gradually, and by piecemeal, to force in the whole body. As soon as this was fairly out of sight, she took her departure and in five minutes returned with another victim. I counted seven of these caterpillars pushed into the same building. The eighth time she returned without a caterpillar, but with a load of clay, with which in an instant she closed up the open door, and immediately began to lay a new foundation. This she finished before noon, and left it to dry for the rest of the day. Next morning I saw her bringing the caterpillars, but did not remain to count them I allowed the process to go on for four days, when with a sharp table knife I removed the first nest from the wainscot, and found the ova hatched, and the caterpillars, in whose bodies they had been deposited, nearly all destroyed by the young grubs. In the second the ova had not burst, and in the third the cell was quite crammed with the still fresh bodies of the green caterpillars. I found in the huts that had not been disturbed, the wall broken on

one side or other, and that when taken down they were quite empty. Here, then, we find the insect first preparing a prison for the caterpillars, in whose bodies she deposits her ova for the purpose of being hatched, and which bodies also supply the young with food, until able to destroy the wall of the building, and find nourishment elsewhere. —*Halliday's West Indies.*

Black is the worst Colour for Painting Woodwork in the Open Air.—There is nothing that will prove this evil more than by observing the black streaks of a ship after being in a tropical climate for any length of time. It will be found that the wood round the fastenings is in a state of decay, while the white work is as sound as ever. The planks that are painted black will be found split in all directions, while the frequent necessity of caulking a ship in that situation, likewise adds to the common destruction; and I am fully persuaded that a piece of wood painted white will be preserved from perishing as long again, if exposed to the weather, as a similar piece painted black, especially in a tropical climate. I have heard many men of considerable experience say, that black is good for nothing on wood, as it possesses no body to exclude the weather. This is, indeed, partly the case; but a far greater evil than this attends the use of black paint, which ought entirely to exclude its use on any work out of doors, viz., its property of absorbing heat. A black unpolished surface is the greatest absorber and radiator of heat known; while a white surface, on the other hand, is a bad absorber and radiator of the same; consequently black paint is more pernicious to the wood than white. Wood having a black surface will imbibe considerably more heat in the same temperature of climate than if that surface were white; from which circumstance we may easily conclude, that the pores of wood of any nature will have a tendency to expand, and rend in all directions, when exposed under such circumstances; the water, of course, being admitted, causes a gradual and progressive decay, which must be imperceptibly increasing from every change of weather. The remedy to so great an evil is particularly simple, viz., by using white instead of black paint, which not only forms a better surface, but is a preventive to the action of heat, and is more impervious to the moisture. The saving of expense would be immense, and I am convinced that men of practical experience will bear me out in my assertion.—*Trans. Society of Arts.*

Discovery of Silk.—Two Persian monks, having been employed as missionaries in some of the Christian churches, which were established (as we are informed by Cosmas), in different parts of India, had penetrated into the country of Seres, or China. There they observed the labours of the silk-worm, and became acquainted with all the arts of man in working up its productions into such a variety of elegant fabrics. The prospect of gain, or perhaps an indignant zeal, excited by seeing this lucrative branch of commerce engrossed by unbelieving nations, prompted them to repair to Constantinople. There they explained to the emperor the origin of silk, as well as the various modes of preparing and manufacturing it. Mysteries hitherto unknown, or very imperfectly understood, in Europe; and, encouraged by his liberal promises, they undertook to bring to the capital a sufficient number of those wonderful insects, to whose labour man is so much indebted. This they accomplished by conveying the eggs of the silk-worm in a hollow cane. They were hatched by the heat of the dunghill, fed with the leaves of the wild mulberry tree, and they multiplied and worked in the same manner as in those climates where they first became objects of human attention and care. Vast numbers of these insects were soon reared in different parts of Greece, particularly in the Peloponnesus; Sicily afterwards undertook to breed silkworms with equal success, and was imitated from time to time in several towns of Italy. In all these places extensive manufactories were established. The demand for silk from the East diminished; of course the subjects of the Greek emperors were no longer obliged to have recourse to the Persians for a supply of it, and a considerable change took place in the nature of the commercial intercourse between Europe and India.

W. C. D.

The Royal Plate.—The plate at Windsor Castle is kept in a tolerably-sized room and an adjoining closet, and is valued at 1,700,000*l.* There is one gold service formed by George IV. to dine 130 guests; some pieces were taken from the Spanish Armada, some brought from India, Burmah, China, &c.; one vessel belonging to Charles XII. of Sweden, and another to the King of Ava, a peacock of precious stones, valued at 30,000*l.*; tiger's head (Tippoo's footstool), with a solid ingot of gold for his tongue, and crystal teeth; numerous and splendidly ornamented gold shields, one made from snuff boxes, value 8,000 guineas, and thirty dozen of plates, which cost twenty-six guineas each plate. The magnificent silver wine-cooler made for George IV., is enclosed with plate glass; its superb chasing and other ornamental work occupied two years, and two full-grown persons may sit in it without inconvenience.

Innocent method of getting rid of Rats.—Lay bird lime in their haunts; for though they are nasty enough in other respects, yet being very curious of their fur, if it is but daubed with this stuff, it is so troublesome to them, that they will even scratch their skins from off their own backs, to get it off, and will never abide in the place where they suffered in this manner. A little gas tar put into rat-holes, will speedily drive rats away.—*Noble's Compendium.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 19, Henry Hancock, Esq., on the Circulation of the Blood. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Dec. 20, Mr. James Burton, on the Applications of Chemistry and Machinery. At half-past eight.

QUERIES.

What is the cause of rockets ascending? How is the multiplication of pounds, shillings, and pence by pounds, shillings, and pence performed?

WILLIAM V—E.

How to make green ink? R. S. L.

Can any of your correspondents inform me where I can purchase a drawing of St George, Bloomsbury church (the front elevation), with the plan, at or about the scale of one inch to five feet, and what they will charge for them? Also to know if any book or print-seller has any of the late J. Taylor's works which he published in April, 1823, on the "Edifices of London" (churches). If I could get a copy of Bloomsbury church from his work, I should prefer it to any other, as it is very correct. I have tried at a great many places, but all have failed.

ARCHITECT.

What is the best method of staining ivory blue; also, the best directions for etching on it?

Should you think fit to insert in the "Mechanic and Chemist" the account which I have sent you of the experiment made at the Cathedral of Armagh, I should be most happy to inform you of other experiments in which the success has been as complete.

T. C. D.

[An account of the experiment alluded to, *was* inserted in the "Mechanic," with some additional explanations by the Ed.]

A description of an electro-magnetic machine for giving shocks? What I principally want to know is, how the mercury cup is made; whether the bar that goes across the bottom of the cup is iron, brass, or wood; whether the wires from the battery are to go both on one side of the bar, or on opposite sides? The cause of the rotary motion of the iron bar, and how the connexion is to be made to give the shock?

MAGNETRON.

How to build a furnace for smelting lead dross? Also, if any and what ingredients are used to cause the metal to separate from the dross? Perhaps your intelligent correspondent, "A. Taylor," may be able to give some information on the subject, for which I shall be extremely obliged. J. T. B.

Would any of your correspondents that have made any of the electrical machines named in the two first volumes of the "Mechanic and Chemist," be so kind as to inform me where I can see one? Also, how are the French watch-wheels polished? How is paint taken out of cloth, &c.? T. R. BILBROUGH.

How to make cloth water-proof? P. T.

ANSWERS TO QUERIES.

How to make and use an Electrical Battery.—"A. M. B. R." It consists of twelve Leyden jars connected together, and placed in a mahogany box, the bottom of which should be covered with tin-foil, to connect all the outside coatings; the inside coatings being connected by the balls and wires that rise from their centres, and are united at the top. On one side of the box, there is a small brass hook to connect the battery, by means of a chain, with any substance through which the discharge is to be made: this hook passes through the box, and is fixed in contact with the tin-foil which connects the exterior coating of the jars. Dr. Franklin formed a battery with eleven panes of common window-glass, with which he made most of his experiments. However constructed, they are charged and discharged in the same manner as a single jar. If one of the knobs of the battery communicate with the prime conductor of the machine in a state of action, it will soon be charged; and the discharge may be effected by making a communication between the coatings, by means of a discharging rod or any other conductor.

T. C. D.

To make Fluoric Acid.—"F. Jones." Put one part of fluate of lime, i. e., fluor spar, in coarse powder into a leaden or tin retort, and pour upon it two parts of sulphuric acid. Lute the retort to a leaden receiver, containing one part of water, and apply a gentle heat. The fluoric acid gas disengaged will be absorbed by the water, and form a liquid fluoric acid; which must be kept in well-closed leaden or tin bottles, or vials coated within with wax or varnish. If the receiver be cooled with ice, and no water put in it; then the condensed acid is an intensely active liquid, first procured by M. Gay Lussac.

Method of Polishing Shells.—A shell which has a smooth surface and a naturally dull polish, needs only to be rubbed with a piece of chamois leather on which is some tripoli, or fine rotten-stone, and it will become of a bright and fine polish. A shell that is rough, foul, or crusty, must be left a whole day in hot water; when it has imbibed a quantity of this, it is to be rubbed with rough emery on a stick, or with the blade of a knife, to get the coat off. After this, it is to be dipped in diluted aquafortis, spirits of salt, or any other acid; and, after remaining a few moments, be again plunged in water. After this, it is to be cleaned with soap on linen cloth; and when by these several means it is made perfectly clean, the polishing is to be finished with fine emery and a hair brush.

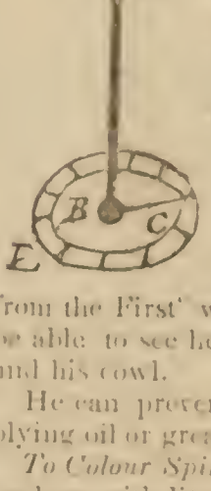
R. S. L.

Dutch Weather-houses.—"A Reader from the First" will find the following sufficient to give him the idea of the manner in which these are formed, the rest he will easily work out for himself. Drive a nail into the wall, bend a fiddle-string round it, twist it underneath for a few inches in the manner of whipcord, and at the bottom tie a skewer. It is evident that, upon letting go the string, it will unwind itself, and the skewer will be swung round. If now a piece of iron wire, of a weight sufficient to counterbalance the strength of the string, be substituted for the skewer, it will remain stationary, and a pasteboard gentleman may be fastened at one end, and a lady of the same material at the other. As the air becomes moist, the string will be contracted, and the wire, of course, turned in one direction; and, on the approach of dry weather, the lengthening of the string will turn it in the other direction. It is plain that the susceptibility of the instrument will be increased by lengthening the string. The

fine word for this, however, is hygrometer, from *υγρος* and *μετρον*, the moisture guage. Hydrometers, *υδωρ*, the water-guage, are for measuring the density of liquids, and consist, generally, of a hollow bulb, furnished with two stems, one of which being kept down by means of a weight, sustains the other in an upright position; this is graduated, and indicates the density of the fluid by the depth to which it sinks; for the rarer the fluid, the less the instrument is brought up, and conversely. The hygrometric toy above described, and all others depending on the contraction or dilatation of the materials employed, become in time less and less accurate, till at last they lose their effect entirely, and suffer no alteration from the weather. The following is at once as simple, and will last for years. Take a piece of deal, a yard long, the eighth of an inch broad, and half as thick. Through a hole in this, at the distance of three or four inches from one end, insert a fine needle and fix the point of it into a piece of wood against a wall. From the short end suspend a piece of sponge sufficiently large to equiponderate the long beam, or, which is better, larger still, in which case a piece of silk, or a horse-hair, may be hung from the long beam with a few dust shot fastened on it. At the end of this long beam describe an arc upon the wall, or upon a piece of paper fastened upon the wall to receive it. The sponge in moist weather becoming damp and heavy, will sink proportionally to the humidity imbibed. The arc may be graduated from observation, and the instrument is complete. Prepare the sponge by washing it in hot water and salt of tartar. A little ingenuity will, of course, suggest a neater modification of this, as well as of the first; but we prefer giving the rough outline, leaving others to improve upon it as they please. This method, we believe, was first employed by Mr. Arderon.

W. W.

The Hygrometer.—Another Description.—"A Reader from the First." A short account of the hygrometer may perhaps be useful to some other reader than the above-mentioned gentleman:—The hygrometer is an instrument to measure the quantity of moisture in the atmosphere. These instruments are of various constructions; some being of strings of hemp, which shorten in moist weather and lengthen in dry. Others are made of the beard or arm of the wild oat, which, by twisting or untwisting, or twisting in moist or dry weather, moves a hand or index; others are made by balancing a piece of sponge against a weight; in damp weather the sponge imbibes the moisture, and becomes too heavy for the weight, but in dry weather it returns to the equilibrium. Some again are made with cat-gut, the fibres of which twisting and untwisting, indicate damp or dry weather. The weather-houses are thus made:—A light piece of wood is suspended by cat-gut, so that it is in equilibrium: the figure of a man is placed on the side of the piece of wood, on which the cat-gut twists, and a figure of a woman is placed on the other side, this is then to be fixed in a small house, with two openings in the front, large enough to admit the figures passing in and out. When the atmosphere is damp the cat-gut twists up, and the man appears at one of the openings; but when the air becomes dry, the man recedes by the untwisting of the cat-gut, and the woman appears. On the same principle is



constructed another hygrometer.—A B, is a cat-gut string suspended at it with a little weight, n, that carries an index, C, round a circular scale, D E, in a horizontal board or table, and as the cat-gut becomes moist or dry, it twists or untwists itself, and the degrees of moisture are shown by the index moving backwards and forwards on the scale. "A Reader from the First" will, from this property of cat-gut, be able to see how it can be applied to the monk and his cowl.

He can prevent leather from cracking by applying oil or grease of any kind to it.

To Colour Spirits of Wine Blue, may, I think, be done with litmus. J. MITCHELL.

TO CORRESPONDENTS.

W. W. *We regret exceedingly the occurrence which has deprived us of the last communication from our much respected correspondent. It is an established practice with all periodical publications, that all communications addressed to the Editor should be post-paid; or, according to the new phraseology, pre-paid. A little reflection must convince everyone of the propriety of this regulation; and the principle being established, the persons in attendance at the Office are accordingly directed to receive only such letters as are pre-paid, or otherwise franked. When we learned that* W. W.'s *letter had been returned to the post-office, we immediately applied there for it, and had the mortification of learning that, agreeably to their oppressive laws, it was destroyed three days after it was returned—thus inevitably preventing the possibility of its recovery, after an explanation from the writer.*

S. Walter, *as soon as the engravings are ready.*

W. E. and H. W. *in our next.*

W. S. Cuthbert.—*We most cordially agree with him in the hope that the present post-office arrangement, or rather de-rangement, will be succeeded by the long talked-of penny postage. He will see our opinion upon that subject, unreservedly expressed in another column. We feel pleasure in transcribing our correspondent's remark upon the gas-burners, which we favourably noticed a few weeks ago.—"I have seen Deeree's two-hole gas-burner, at one or two places, and can state, with the greatest impartiality, that it is decidedly superior to any that I have seen."*

The paper on the "Elements of Chemistry," will represent alternate, but it shall be attended to

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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LAUHGING GAS.

VOL. V.—No. 18.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

NITROUS OXIDE, OR LAUGHING GAS.

It was at the risk of his life, that Sir H. Davy discovered the surprising properties of this gas: for previous to his experiment, it was supposed that death would be the consequence of introducing it into the lungs. Nitric oxide very nearly resembles it, and that gas cannot be inhaled without fatal consequences. We therefore feel it our duty to recommend that this experiment should not be made without the assistance of an experienced chemist. The following is extracted from "The Book of Experiments":—

"HOW TO MAKE LAUGHING GAS.

There are various methods of procuring this gas; but we think our readers will find it best to obtain it from nitrate of ammonia. This should be placed in a glass retort, and exposed to the flame of a spirit lamp. It will soon melt, and shortly afterwards the gas will be evolved. It should be collected in a receiver, placed in a pneumatic trough, as shown in the engraving, and allowed to stand a short time over water, in order to remove any impurities with which it may be contaminated. The nitrate of ammonia, when melted, should only be kept simmering; for if the heat be increased too much, it will cause a slight explosion, and nitric oxide and nitrogen gas will be produced. If it be wished to make a considerable quantity of the gas, it will be advisable, on the ground of cheapness, for the operator to prepare the nitrate of ammonia himself. This may be done by pouring diluted nitric acid on carbonate of ammonia, and evaporating the solution till the greater portion of the water is gone.

SINGULAR EFFECTS OF LAUGHING GAS.

Protoxide of nitrogen, nitrous oxide, or, as it is more generally termed, laughing gas, is a compound that the young chemist generally desires to procure as soon as possible; and we are induced, therefore, to give the following description of its properties, and of the method to be adopted for obtaining it in a state of purity, although he must not expect to do so without considerable trouble, and some disappointment. Nitrous oxide is a compound of the same elements as those which constitute the atmosphere; but, in consequence of containing a greater quantity of oxygen, its effects upon the human frame, when breathed for a short period, are very surprising. It is not a gas that can be breathed with impunity for any great length of time, yet it can be received into the lungs for a short period without injury. It is termed laughing gas, because its general effect upon persons who respire it is to induce a very strong desire to give way to violent fits of laughter. It does not, however, produce this effect on every individual. Some are made exceedingly melancholy, and others appear desirous of annihilating everything on which they can lay their hands. In general, however, the gas only excites the person who breathes it to laughter. It acts as a powerful stimulant for a time, but, unlike other stimulants, it is not followed by lassitude, or lowness of spirits, unless, while under its influence, the person is excited to excessive muscular exertion. Sir Humphrey Davy made a variety of experiments with this gas. He administered it to various persons, and, indeed, was the first to investigate its properties with any degree of accuracy. Previously to his time, the gas was considered to be unfit for the purpose of respiration, but Davy found that it could be breathed with safety; and in his farther experiments on it discovered the singular effects it produces. After a few inspirations of it have been made, it causes a sense of lightness and expansion in the chest, and a pleasurable sensation begins to extend over the whole body; this increases, and is accompanied with a desire to inhale the gas; respiration becomes, therefore, fuller, and is performed with more energy. Exhiliration is soon produced; and if the respiration is continued sufficiently long, a crowd of indistinct ideas, often in very singular combinations, pass through the mind; there is an irresistible propensity to laughter, and to muscular exertion, and violent efforts are made with alacrity and ease. These effects, after the inspiration has ceased, continue for four or five minutes, or sometimes longer; they gradually subside, and what is not the least singular, the state of the system returns almost immediately to its usual standard.

We have frequently administered the gas to others, and have breathed it ourselves; and when this is done in a proper manner, we have never failed to observe or feel the effects above described. There is, however, some difficulty in administering the gas properly to a person who has never taken it before. It must be enclosed in a bladder, fitted with a stopcock; and unless the person inhales it from the bladder without allowing any of the atmosphere to enter his lungs at the same time, the experiment will not succeed. The best way is, to close the nostrils with the left hand, and then, forcing all the air possible from the lungs by a strong respiration, to place the stopcock in your

mouth, and so breathe in and out of the bladder, at the same time keeping the nostrils quite closed. If this be done properly, the gas is sure to produce its usual effects. When it is administered to a person, unless he has taken it previously, and is aware of the manner in which it affects him, it is desirable to have some one near to prevent his doing any mischief, in case he should feel so inclined. Self-command is in general entirely lost for a few minutes, although the individual is perfectly sensible all the time in what a ridiculous manner he is behaving."

PRODUCTION OF GAS FROM WATER.

It is a general, though very erroneous supposition, that water is destitute of the elements of combustion; it is, however, clearly demonstrated by chemical analysis, that water, though so opposed to combustion in its combined state, consists of oxygen and hydrogen, which, when combined in a different form, produce by their combustion the most intense heat, and a flame which, when projected against lime, generates the brightest light that can be obtained by artificial means. "Setting the Thames on fire" is no longer a proverbial impossibility; for one of the inflammable elements, hydrogen, may be easily separated and collected by a simple process An experiment in gas-lighting was made last week by the Comte de Mal Varino on a piece of waste ground at the back of Fetter-lane, in the presence of several scientific gentlemen. The gasometer was connected by tubes with a brick furnace containing three retorts, one of which was supplied with water, and another with tar, and both discharged their produce into the third retort, in which the gaseous elements were decomposed. The novelty of the experiment consisted, in fact, that the principal agent employed to produce the gas, was common water combined with tar; but, according to the theory of the inventer, any sort of bituminous or fatty matter would answer the purpose equally as well as pitch or tar. After the lapse of about half an hour employed in the experiment, during which time the process was explained to the company, the gas was turned into the burners, and a pure and powerful light was produced, perfectly free from smoke or any unpleasant smell. The great advantage of this sort of gas over the common coal gas, consists, it was said, in the cheapness of the materials employed in its production, the facility with which it is manufactured, and the perfection to which it is at once brought, without the necessity of its undergoing the process of purification; for in this instance the light was immediately produced in a perfect state within a few feet of the gasometer. With regard to the comparative expense, it was stated that 1,000 cubic feet of gas manufactured by this process, could be supplied to the public for about one-third the price now charged by the coal-gas companies. If it should be proved that the mixture of pure hydrogen with the illuminating gas obtained from bituminous matter can be effected without diminishing the intensity of the light, the decomposition of water will cease to be a mere experiment for the amusement of the curious, and become a source of important and permanent benefit to society.

ON THE

RELATIVE COMBINATIONS OF THE CONSTITUENTS OF CAST IRON, STEEL, AND MALLEABLE IRON.

By Dr. Charles Schafhaeutl, of Munich.

The author showed, that the purest carbon contained and retained hydrogen, and sometimes azote, even at the highest temperatures, and parted with neither of them, nor were its own internal and external properties altered, except when it attacked the crucible, and combined instead with oxygen, or aluminum, or silicon. He affirmed, that we possessed no certain method of procuring pure carbon in the isolated state, and that what we considered to be pure carbon was always, more or less, in the state of *carburet*. The author described a new method of obtaining graphite—viz., by running fluid puddling slag, or silicates of iron and manganese, over fragments of pit coal. After cooling, the surface of the slag is always found to be altered, and to be covered with a very easily separable layer of graphite, not only where the slag actually touches the coal, but even where it comes in contact with the smoke evolved from the coal. The formation of graphite commences at a temperature lower than 1500° Fahr., and reaches its highest point not much exceeding 2000°. Two different sorts of graphite were produced in this way; one, which he marked graphite (A), was in elastic scales, of the thickness of writing paper, with a rather dull metallic appearance. The graphite marked (B) was of the thickness of gold leaf, and extremely light and unctuous to the touch. He found, that all sorts of graphite lost their

unctuosity and bright appearance by exposing them to the action of concentrated hydro-fluoric acid gas. Graphite (B) was found to consist of—

Protoxide of iron	18.6000
Silica	7.6200

probably mechanically, but equally and invisibly intermixed with,

Carbon	70.3421
Silicon	3.0744
Loss	00.3635
	100.0000

Graphite (A) gave—

4.93	Silicon.
9.50	Iron.
85.45	Carbon.
00.12	Loss.
100.00.	

The quantity of oxides of iron and silica had been ascertained by heating the specimens first with acids and caustic leys; the quantity of carbon, by burning the specimens with chromate of lead and chlorate of potash; and the silicon, by melting the powders with carbonate of soda in a platinum crucible. He considered, therefore, the graphite to be a *carburet of silicon* and iron; and showed, by heating in a *peculiar* way the remainders, left after the solution of iron in chlorohydric acid of a certain specific gravity, that the chemical composition of cast iron, in its two distinct species of grey and white cast iron, had direct relation to the two specimens of graphite, and in all probability were derived from similar origin, as indicated in the following table :—

Graphite (B).

Iron, Silicon	Oxygen.	Silicate of iron.
Silicon, Carbon		Carburet of silicon.

Graphite (A).

Iron, Carbon		Carburet of iron.
Carbon, Silicon		Carburet of silicon.

Grey Cast Iron.

Iron, Silicon, (Aluminum)		Silicet and aluminet of iron.
Carbon, Silicon		Carburet of iron.

White Cast Iron.

Iron, Carbon, Azote		Carburet of iron.
Silicon, Carbon		Carburet of silicon.

It was farther shown, that all grey iron, produced by heated air as well as by cold air, left a greyish white residue behind, after treating it with chlorohydric acid of a certain specific gravity. This remainder, acted upon with caustic ammonia, evolved very rapidly pure hydrogen gas, and alumina afterwards was found in the solution with a little silica. The presence of aluminum in its metallic state, after having been treated with acid, as well as the absence of all *azote*, seemed to be one principal feature *of grey iron of France* as well as of England; as, on the contrary, carbon, hydrogen, and *azote* are always present in the remainders of *white iron*, which remainders appear invariably of a brownish colour; and that azote was a constituent of steel as well as of wrought iron. Farther, it was explained, that silicon generally was combined with *carbon*, and dissolved in the carburets of iron, and that it was extremely difficult to produce an alloy of iron with silicon alone, without the presence of a little carbon, aluminum, and other similar bodies. He found the molecules of all iron of a similar form, belonging to the cubical system, and the largest not exceeding 0.0000633 of an inch in diameter, and that particularly upon the arrangement of these molecules depends, in a great measure, the different appearance of the different kinds. He denied that any graphite scales were to be seen in grey cast iron; yet, that under a magnifying glass what appeared to the naked eye graphite scales, were really surfaces and planes of crystallization, composed of pentagonal planes not wider in the smallest diameter than 0.000355 of an inch, and composed of the before-mentioned smallest or primitive iron molecules. According to his statement, the molecules of the iron are arranged in the grey cast iron in the most regular form, having all their surfaces in one plane. The most equal distribution of molecules appeared in hardened steel; collecting in fascicular aggregation in soft steel, and being loose and longitudinally arranged in wrought iron. He stated that pure iron could not be welded; that the welding power of iron depended on its alloy with the carburet of silicon, and also that

the good and various qualities of all the wrought irons depended on the alloys of pure iron with other metallic bodies; and that the presence of most of the electro-negative metals had been generally overlooked in the existing analysis of iron. The presence of arsenic in Swedish steel, when forged red-hot, could be ascertained by its smell, as well as in the Low Moor iron. The usual solution of iron under analysis, in order to separate those metals from the iron, must be, for the necessary correction, divided into two parts,—one to be treated with a current of sulphuretted hydrogen, the other part *dropped* into sulphydrate of ammonia, and carefully digested. A small quantity of silica was more difficult to separate from a large quantity of iron than generally seemed to be believed; and the real amount of carbon could *only* be ascertained by Berzelius's method of burning iron in a current of oxygen, or mixed with chlorate of potash and chromate of lead in a glass tube, used first by Berzelius for analysis of organic bodies. The author maintained that steel was an entirely mechanical production of the forge hammer, which tore the molecules of certain species of white cast iron out of their original position, into which the forces of attraction in respect to the centres, as well as to the position of the molecules, had arranged those molecules by the slow action of heat. Steel, as it came out of the converting furnace or the crucible, was nothing more nor less than white cast iron, of which Indian steel, called Wootz, was the fairest specimen. The author finally gave an analysis of two specimens of cast iron and one of steel. The first specimen was French grey iron, from Vienne, Department de l'Isere, obtained from a mixture of pea-iron-ore with red hematite, by means of coal from Rive de Gier and heated air, specific gravity 6.898. The second iron was Welsh iron, from the tin-plate manufactory of the Maesteg ironworks, near Neath, in South Wales, obtained from a mixture of clay iron-stone and Cumberland red ore, by means of coke and heated air. It was silvery white, without signs of crystallization; specific gravity 7.467. The third specimen was a fragment of a razor, forged in the author's presence, in the workshop of Mr. Rodgers, of Sheffield, of the specific gravity of 7 92.

	Grey French Iron.	White Welsh Iron.	Steel.
Silicon	4.86430	1.00867	0.52013
Aluminum	1.00738	0.08571	0.00000
Manganese	0.75130	traces.	1.92000
Arsenic	0.00000	0.00000	0.93400
Antimony	0.00000	1.59710	0.12100
Tin	0.00000	0.00000	traces.
Phosphorus	0.54000	0.08553	0.00000
Sulphur	0.17740	0.32018	1.00200
Azote	0.00000	0.76371	0.18310
Carbon	3.38000	4.30000	1.42800
Iron	89.00740	91.52282	93.79765
Loss	00.27222	00.31428	0.09382
	100.00000	100.00000	100.00000

Several gentlemen, among whom were some connected with the iron trade, expressed a high sense of the value of this communication, from which it appeared that the peculiarities of Swedish iron, in a great degree, depended on the presence of arsenic, and those of Russian iron on the presence of phosphorus.

How to Kill Slugs.—Take a quantity of cabbage leaves, and either put them into a warm oven, or hold them before a fire, till they get quite soft; then rub them with unsalted butter, or any kind of fresh dripping, and lay them in the places infested with slugs. In a few hours the leaves will be found covered with slugs and snails, which may then be destroyed in any way the gardener may think fit.—*Gardener's Mag.*

Swedish Method of Preserving Apples.—They are skinned and quartered, and then half baked, which produces a disagreeable, shrivelled appearance; but they retain their flavour, and in that state can be kept any length of time.

GUIDE FOR YOUNG VIOLINISTS.

To the Editor of the Mechanic and Chemist

Sir,—I beg to enclose you a representation of a simple discovery made a few days ago, which may perhaps be of service to some of the readers of your valuable and entertaining publication. It is a belt made to go round the waist and buckle in front with an elastic strap affixed to the right hand side of it, to go round the arm and buckle, thereby keeping the arm close to the side, and affording a facility to the learner of the violin in acquiring the art of holding his bow.

I remain yours, &c.,

Apollo.

A, Waist belt.
B, Elastic arm strap.
C, The buckle of B.

THE CHEMIST.

ACIDS.

NO. XII.

Sulpho-cyanic Acid is most readily obtained by the following process, contrived by Vogel:—Mix equal weights of flowers of sulphur and powdered ferrocyanate of potassa, and keep the mixture melted in a flask for half an hour; when cold, reduce the mass to powder, and digest it in water, filter the solution, and add a sufficiency of liquid potassa to throw down the iron held in solution. The liquid thus obtained is a solution of the sulpho-cyanuret of potassium, from which liquid sulpho-cyanic acid may be obtained by distillation with phosphoric or sulphuric acid. Thus procured, it is of a pinkish hue, with an acetic odour, and is characterized by the peculiar blood-red colour which it produces when mixed with persulphate of iron. It reddens litmus, and neutralizes the alkalies, and forms a white insoluble salt with protoxide of copper. When concentrated, its specific gravity is 1.022. It boils at 217°, and at 15° it crystallizes. Most of its salts are soluble in alcohol. Its combinations are called *sulpho-cyanates*.

Sulpho-napthalic Acid.—It can be obtained pure by the following process:—Napthaline, fused with half its weight of sulphuric acid on cooling, forms a red crystalline compound, soluble in water; carbonate of baryta, added to its solution, forms sulphate and sulpho-napthalate of baryta, the former insoluble, but the latter soluble; its solution is to be filtered off, and sulphuric acid to be added to it in sufficient quantity to precipitate the baryta. An aqueous solution of sulpho-napthalic acid is thus obtained. of a bitter acid taste, and powerfully reddening litmus; concentrated by evaporation, it becomes brown, thick, and ultimately solid, and very deliquescent. By renewed heat it melts and chars, but does not inflame, and ultimately gives sulphuric and sulphurous acid vapours, and leaves charcoal. Its salts are termed *sulpho-napthalates*.

Tartaric Acid is generally obtained from the bitartrate of potassa. Mix 100 parts of this salt in fine powder with 30 of powdered chalk, and gradually throw the mixture into ten times its weight of boiling water; when the liquor has cooled, pour the whole upon a linen strainer, and wash the white powder which remains with cold water; this is a tartrate of lime; diffuse it through a sufficient quantity of water, add sulphuric acid equal in weight to the chalk employed, and occasionally stir the mixture during twenty-four hours, then filter, and carefully evaporate the liquor to about one-fourth its original bulk; filter again, and evaporate with much care nearly to dryness; redissolve the dry mass in about six times its weight in water; render it clean by filtration; evaporate slowly to the consistence of syrup, and set it aside to crystallize. By two or three successive solutions and tartarizations, tartaric acid will be obtained in colourless crystals, soluble in six parts of water at 60°. They are rectangular prisms, terminated by dihedral or four-sided pyramidal summits. Their specific gravity is 1.600. They fuse at a temperature a little above 212° into a fluid which boils at 250°, and leave a semi-transparent mass on cooling. Its salts are called *tartrates*.

To the Editor of the Mechanic and Chemist.

Sir,—In looking over your last number but one, I find your correspondent, "A Taylor," has fallen into a slight error in stating that gold leaf is impervious to the passage of light. Any person may prove that light passes through it; by holding a piece of common gold leaf up to the light, they will see it passes through, of a bluish green colour. Hoping that "A. T." will not take this interference offensively,

I remain yours, &c.,

J. Mitchell.

MISCELLANEA.

Animalcules.—By the discoveries of the microscope we find, that in a single drop of water there are myriads of animals, creatures of which it would require nearly a thousand millions to form a cubic inch, all recreating and executing their various functions and evolutions with as much rapidity and apparent facility, as if the range afforded them were as boundless as the ocean. Animalcules bear no resemblance whatever to animals which we see with the naked eye. They are of all imaginable shapes; their figures resemble round balls, ovals, eels, snakes, corkscrews, funnels, tops, cylinders, pitchers, wheels, flasks, purses, semicircles, kidneys, dots with tails, tobacco-pipes, flowers, branches of trees, egg-cups, and some have the appearance of a tulip with a flowery bulb and stalk. The apparently incalculable number of forms of animalcules is not more puzzling to the investigator than their assumption of new forms. Most creatures that we know of produce young after their kind, either at once bringing forth their progeny into life, or through the medium of eggs, but always producing young resembling themselves in figure. Animalcules, however, have generally a different way of coming into existence. One class propagates by spontaneous scissure, a division of their bodies into two or more portions, each one forming a new creature, which, on its arrival at maturity, pursues the same course. In thus cutting themselves in pieces, they are very capricious in their fancy; sometimes they divide straight across, sometimes lengthwise, and sometimes diagonally, and what forms the chief difficulty in understanding them, the pieces so separated do not resemble the original: an animalcule resembling a ball will give birth (if this word can be properly applied) to a number of triangles. Another class of animalcules propagate by the distribution of the internal substance of the parent, of which nothing is left but the envelop, soon to be dissolved; a third class are produced from germs shooting out from the sides of the parent; and most likely there are many other ways by which they come into life, of which naturalists have yet no knowledge.—*The Naturalist.*

Value of Machinery.—The creation of employment among ourselves by the cheapness of cotton goods produced by machinery, is not to be considered as a mere change from the labour of India to the labour of England. It is a creation of employment, operating just in the same manner as the machinery did for printing books. The Indian, it is true, no longer sends us his calicoes and his coloured stuffs; we make them ourselves. But he sends us forty times the amount of raw cotton that he sent when the machinery was first set up. In 1781 we imported five million pounds of cotton wool. In 1828 we imported two hundred and ten million pounds—enough to make twelve hundred and sixty million yards of cloth—which is about two yards a-piece for every human being in the world. The workman on the banks of the Ganges (the great river of India) is no longer weaving calicoes for us, in his loom of reeds under the shade of a mango tree; but he is gathering for us forty times as much cotton as he gathered before, and making forty times as much indigo for us to colour it with. The export of cotton has made such a demand upon the Indian power of labour, that even the people of Hindostan, adopting European contrivances, have introduced machinery to pack the cotton. Bishop Heber says, that he was frequently interested by seeing, at Bombay, immense bales of cotton lying on the piers; and the ingenious screw, by which an astonishing quantity is pressed into the canvass bags. The Chinese, on the contrary, from the want of these contrivances, sell their cotton to us at much less profit; for they pack it so loosely, that it occupies three times the bulk of the Indian cotton, and the freight costs twelve times the price to which it might be reduced by mechanical skill. When the Chinese acquire the knowledge from other nations, which their institutions now shut out, they will know the value of mechanical skill, in preference to unassisted manual labour.—*Results of Machinery.*

Pins.—The pin was not known in England till towards the middle or latter end of the reign of Henry VIII; the ladies till then using ribbons, loops, skewers made of wood, of brass, silver, or gold. At first the pin was so ill made, that in the 44th year of the king, Parliament enacted that none should be sold "unless they be double-headed, and have the heades soudered fast to the shanke of the pynne."

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 26, R. A. Ogilvie, Esq., on Insects. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Monday, Dec. 31. Quarterly Meeting. At half-past eight.

QUERIES.

A receipe of the preparation of a cheap ink, of any dark colour, to mark calico, that will resist the power of an alkali when boiled in water, and the method of using the same. L. D.

How square glass shades are made, the composition on the edges (if it is composition), and gilt afterwards; and likewise the gold enamelling on glass, how the lines are ruled? The above shades are those used for clocks, striped birds, and other fancy articles. T. H. L. L.

1. What change takes place in the elementary parts of animal and vegetable substances, when submitted to the action of the ordinary bleaching agents, as chlorine, &c.?

2. Whether any difference exists between the basis of the colouring matter of animal substances and that of vegetables?

3. The easiest way to prepare naptha, or pyrolixic spirit, on a small scale, from the wood liquor of the mordant makers?

4. I have lately heard that bread may be made, and has been made from sawdust of wood, or in other words, from wood itself, the bread being highly nutritious; is there any truth in this, and if so, in what book can I see the process described? AN AMATEUR CHEMIST.

ANSWERS TO QUERIES.

"R H." can have a working model (if required to scale, and embracing full detail) made at a moderate price, by applying (if by letter post paid) to J. T., 19, New Compton-street, St. Giles.

How to make the Drummond light.—The Drummond, or lime light, is made by throwing the flame produced by the combustion of the oxygen and hydrogen gases on a small piece of lime. It is the same as the Koniaphostic light, lately exhibited at the Surrey Zoological Gardens.

How to make differently coloured Stains for Paper.—Paper may be stained as follows—

Blue, by a solution of indigo in sulphuric acid. One part of indigo is to be digested in four parts of sulphuric acid for 24 hours; to the solution, one part of dry carbonate of potass is to be added, and then it is to be diluted with eight parts of water.

Yellow, with a strong decoction of either quercitron or fustic; the paper must be washed with a solution of alum in water before it is washed with the decoction; two ounces of either quercitron or fustic, to one pint and a half of water, to be boiled down to a pint.

Red, with a decoction of either Brazil wood or cochineal; with the latter the colour is finest. The paper must be sponged over with a solution of pearlash before using the Brazil wood, and with a solution of nitro-muriate of tin before using the cochineal.

Green, by a mixture of the blue and yellow stains.

Orange, by a decoction of turmeric; the paper to be previously washed over with a solution of pearlash.

Purple, with a decoction of logwood, the paper to be previously washed over with a solution of alum.

The Bude Light is formed by passing a stream of oxygen gas through the centre of the flame of an Argand lamp.

Which is the lightest, silk or bladder, for a small balloon?—Bladder, I should say. The prepared turkey's maw is generally used for the purpose. J. MITCHELL.

To Polish Glass.—Glass is polished by rubbing it with a leather dressed with putty powder (oxide of tin), wetted from time to time, when it works too stiffly. The leather is generally attached to a piece of wood, whose shape varies according to the work it has to perform.

To make Green Ink.—"R. S. L." According to Klaproth, a fine green ink may be prepared by boiling a mixture of two parts of verdigris in eight parts of water, with one of cream of tartar, till the total bulk be reduced to one half. The solution must then be poured through a cloth, cooled and bottled for use.

Etching on Ivory.—The ivory must be first covered with wax, or, what is better, the following composition:—2 ounces of asphalt, 1 ounce of white rosin, half an ounce of white wax; either of the grounds being applied, the figure or pattern must be traced through it; the surface must then be covered with strong sulphuric or muriatic acid: after the operation the wax may be washed away with turpentine.

To Dye Ivory Blue.—When ivory is kept immersed for a longer or shorter time in dilute solution of indigo (the sulphate) partly saturated with potass, it assumes a blue tint of greater or less intensity. JUVENILE ENTERTAINER.

TO CORRESPONDENTS.

F. V. E.—*The force which causes rockets to ascend is not "the resistance of the air against the flame," but the upward pressure caused by the combustion. Let a hollow cylinder, closed at each end, be filled with steam, or condensed air; if an aperture, equal to one-tenth of the whole area of the base, be then made at one end, the pressure at that end will be reduced one-tenth, and the cylinder will be impelled in a direction contrary to that of the escaping current, with a force equal to the difference of the entire base, and the remaining part of the perforated one. This is the principle upon which Hiero constructed the first recorded steam-engine. If a continual supply of elastic fluid be produced, and one of the bases be entirely removed (as it is in rockets, and other similar fireworks), the whole pressure upon the remaining base will be effective in imparting motion to the projectile, whether it move in a resisting medium, or in vacuo.—His remarks upon multiplication will be noticed in our next.*

A. W. M.—*Small iron articles may be tinned by cleaning them with a file or scraper, and then dipping them into a solution of sal ammoniac, and afterwards into melted tin. When they are taken out, they will be covered with a coating of tin.*

Alpha *will perceive that we have availed ourselves of the various extracts he has sent us; some are delayed for the purpose of adding farther explanations, but will ultimately appear.*

ERRATA.—Line 49, page 107, column 1, for "are," read *is*; line 55, page 107, col. 2, for "contains," read *combines with*.

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THE

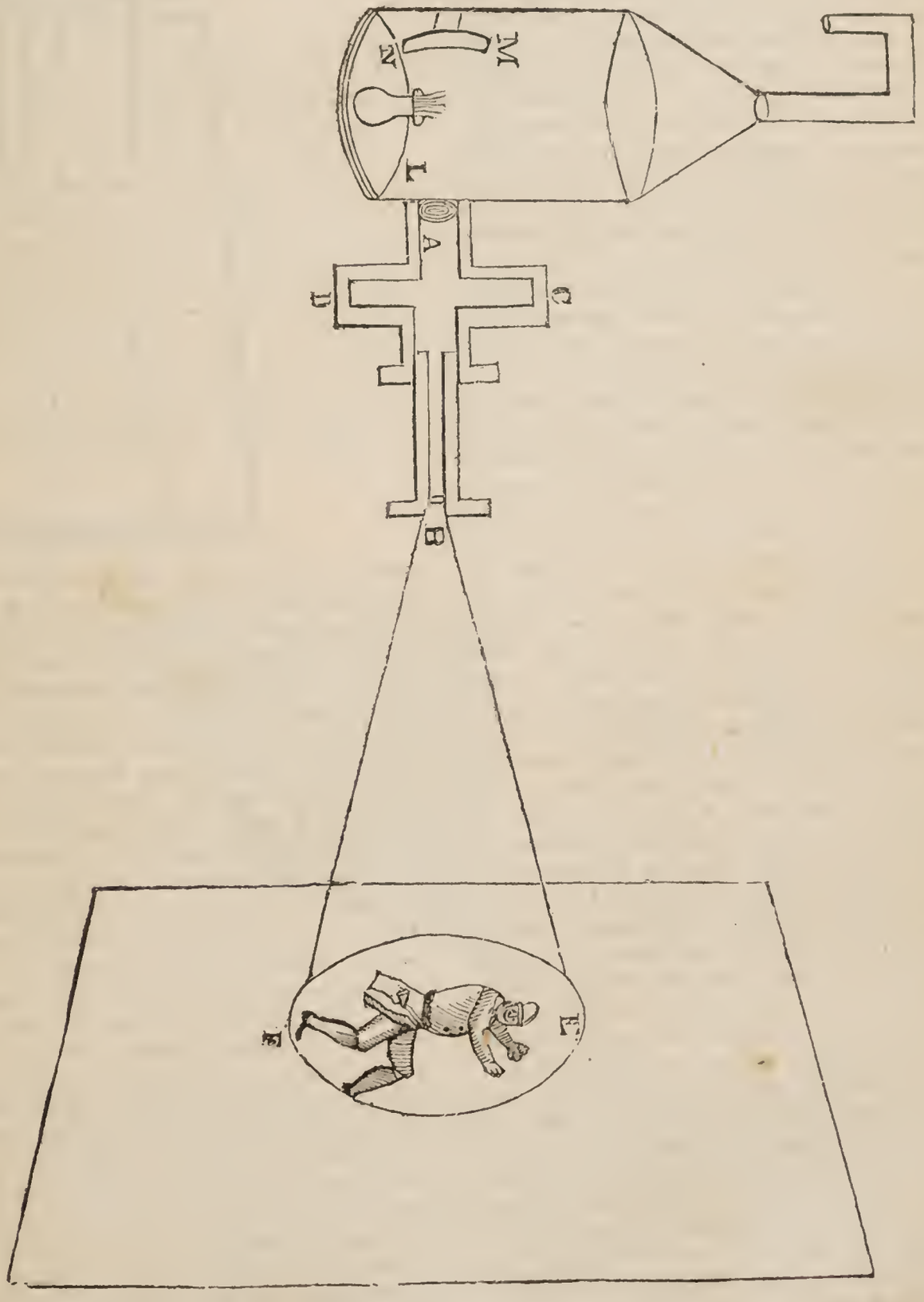
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 68, NEW SERIES. } SATURDAY, DEC. 28, 1839. PRICE ONE PENNY. { No. 189, OLD SERIES.

THE MAGIC LANTERN.

FIG 2.



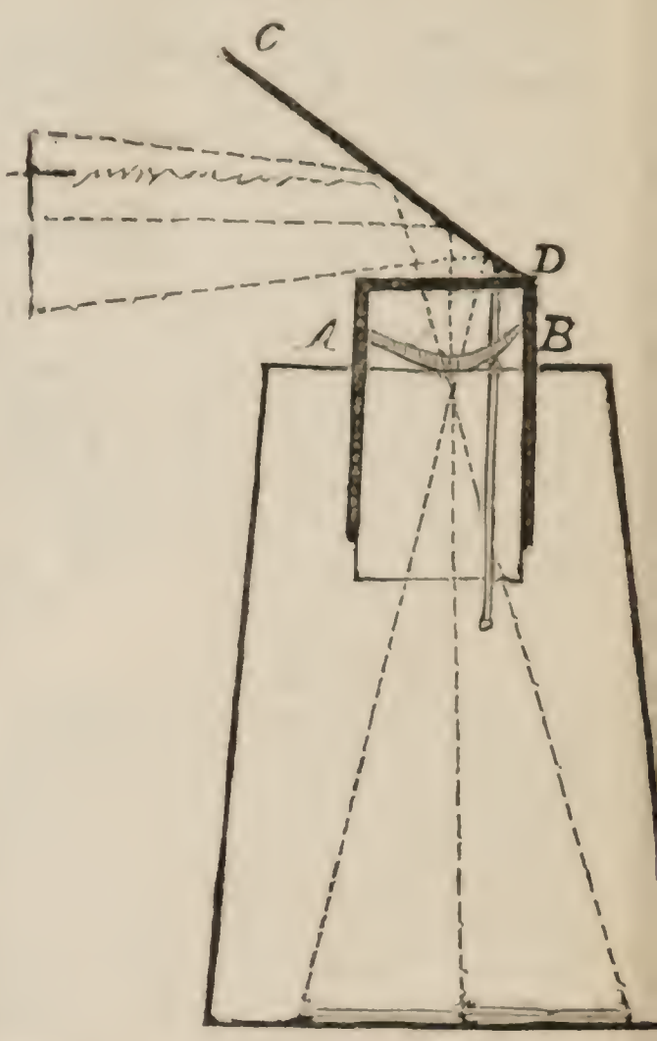
VOL. V.—No. 19.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

OPTICAL INSTRUMENTS.

NO. V.

THE camera obscura is the name of an amusing and useful optical instrument, invented by the celebrated Baptista Porta. In its original state, it is nothing more than a dark room with an opening in the window shutter, in which is placed a convex lens of one or more feet focal length. If a sheet of white paper be held perpendicularly behind the lens, and passed through its focus, there will be painted upon it an accurate picture of all the objects seen from the window, in which the trees and clouds will appear to move in the wind, and all living objects to display the same movements and gestures which they exhibit to the eye. The perfect resemblance of this picture to nature, astonishes and delights everyone, however often he may have seen it. The image is, of course, inverted; but if we look over the top of the paper, it will be seen as if it were erect. The ground on which the picture is received should be hollow, and part of a sphere, whose radius is the focal distance of the convex lens. It is customary, therefore, to make it of the whitest plaster of Paris, with as smooth and accurate a surface as possible. In order to exhibit the picture to several spectators at once; and to enable any person to see it, it is desirable that the image should be formed upon a horizontal table. This may be done by means of a metallic mirror placed at an angle of 45° to the refracted rays, which will reflect the picture upon the whole ground lying horizontally; or, as in the portable camera obscura, it may be reflected upwards by a mirror, and received on the lower side of a plate of ground glass, with its rough side uppermost, upon which the picture may be copied with a fine sharp-pointed pencil. A very convenient portable camera obscura for drawing landscapes or other objects, is shown in fig. 1, where A is a meniscus lens, with its concave side uppermost; and the radius of its convex surface being to the radius of its concave surface as 5 to 8; and C D, a plain metallic speculum, inclined to an angle of 45° to the horizon, so as to reflect the landscape downwards through the lens, A B. The draughtsman introduces his head through an opening in one side, and his hand with a pencil through another opening, made in such a manner as to allow no light to fall upon the picture, which is exhibited on the paper at E F. The tube containing the mirror and lens can be turned round by a rod within, and the inclination of the mirror changed so as to introduce objects in any part of the horizon. When the camera is intended for

Fig. 1.



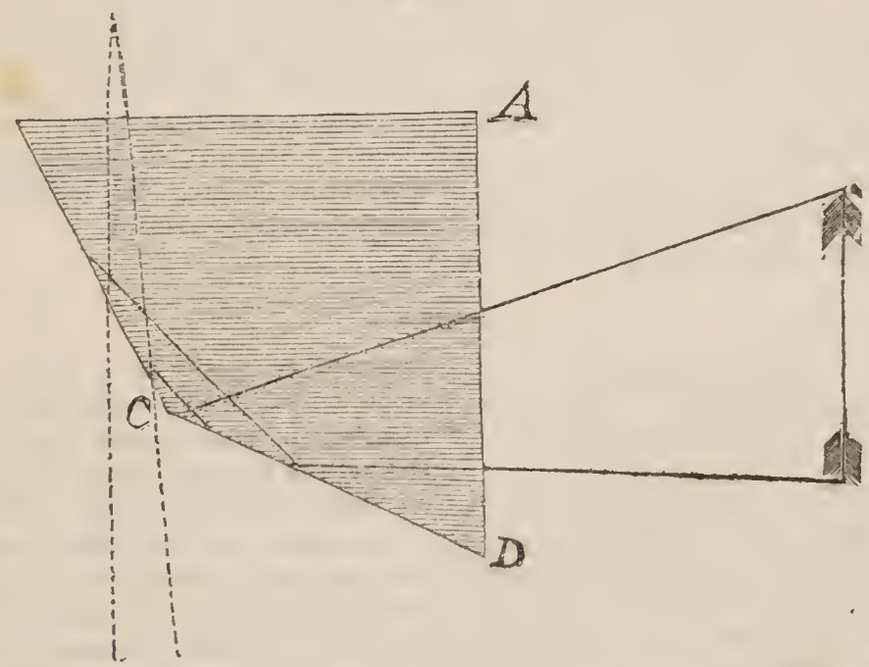
public exhibition, it consists of the same parts similarly arranged; but they are in this case placed on the top of a building, and the rotation of the mirror and its motion in a vertical plane, are effected by turning two rods within the reach of the spectator, so that he can introduce any object into the picture from all points, and at all distances. The picture is received on a table, whose surface is made of stucco, and of the same radius as the lens, and this surface is made to rise and fall to accommodate it to the change of focus produced by objects at different distances. A camera which throws the image down upon a horizontal surface, may be made without any mirrors, by using any of the lenticular prisms, D E F, G H I, M L N, and P Q R (page 11), where the objects are extremely near. The convex surfaces of these prisms converge the rays which are reflected to their focus by the flat faces, D E, G H L N, and P Q; these lenticular prisms may be formed by cementing plano-convex or concave lenses on the faces A B, B C, of the rectangular prism, A B C, or the convex lens may be placed near to A B. A modification of the

camera, called the megascope, is intended for taking magnified drawings of small objects placed near the lens. In this case, the distance of the image behind the lens is greater than the distance of the object before it. By altering the distance of the object, the size of the image may be reduced or enlarged. The hemispherical lens, L M N (page 41), is particularly adapted for the megascope.

The Magic Lantern—an invention of Kircher (a representation of which is given in fig. 2, front page), where L is a lamp, with a powerful Argand burner, placed in a dark lantern. On one side of the lantern is a concave mirror, M N, the vertex of which is opposite to the centre of the flame which is placed in its focus. In the opposite side of the lantern is fixed a tube, A B, containing a hemispherical illuminating lens, A, and a convex lens, B; between A and B, the diameter of the tube is increased for the purpose of allowing sliders to be introduced through the slit, C D. These sliders contain four and five pictures, each painted and highly coloured, with transparent varnishes; and by sliding them through C D, any of the objects may be introduced into the axis of the tube, and between the two lenses, A B. The light of the lamp, L, increased by the light reflected from the mirror falling upon the lens, A, is concentrated by it upon the picture in the slider; and this picture being in one of the conjugate foci of the lens, B, an enlarged image of it will be painted on a white cloth, or on a screen of white paper, E F, standing or suspended perpendicularly. The distance of the lens, B, from the object or the slider, may be increased or diminished by pulling out or pushing in the tube, B; so that a distinct picture of the object may be formed of any size and of any distance from B within moderate limits. If the screen, E F, be made of fine semi-transparent silver paper, or fine muslin properly prepared, the image may be distinctly seen by a spectator on the other side of the screen. The phantasmagoria is nothing more than a magic lantern, in which the images are received on a transparent screen, which is fixed in view of the spectator. The magic lantern mounted upon wheels is made to recede from, or approach to, the screen; so that the picture on the screen expands to a gigantic size, or contracts into an invisible object, or mere luminous spot.

Camera Lucida—an invention of Dr. Wollaston, and much used for drawing landscapes, delineating objects of natural history, and copying and reducing drawings. Dr. Wollaston's form of the instrument is shown in fig. 3, where A B C D

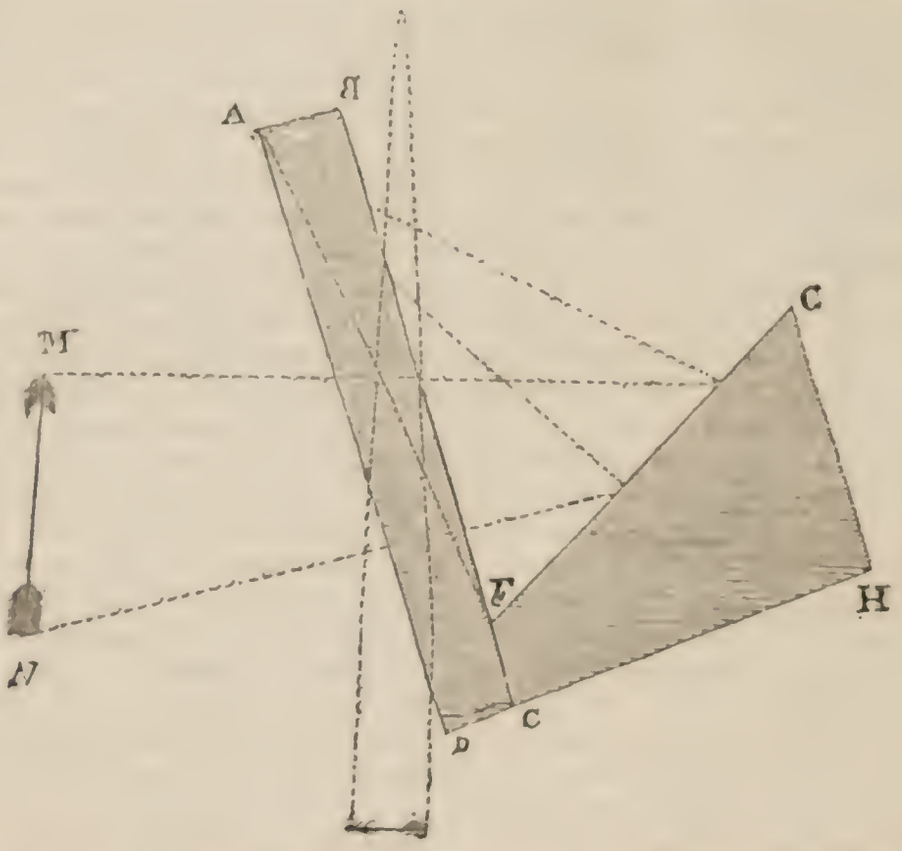
Fig. 3,



is a glass prism, the angle B A D being 90°, A D C 67½, and D C B 135°. The rays proceeding from any object, M N, after being reflected by the faces, D C, C B, to the eye at E, placed above the angle, B, the observer will see an image, *m n*, of the object, M N, projected upon a piece of paper at *m n*. If the eye be now brought down closely to the angle, B, so that it at the same time sees into the prism with one half of the pupil, and past the angle, B, with the other half, it will obtain a distinct vision of the image, *m n*, and also see the paper and the point of the pencil. The draughtsman has, therefore, only to trace the outline of the image upon the paper, the image being seen with half the pupil, and the paper and pencil with the other

half. Many persons have acquired the art of using the instrument with great facility, while others have entirely failed. In examining the causes of this failure, Professor Amici, of Modena, succeeded in removing them, and has proposed various forms of the instrument, free from the defects of Dr. Wollaston's. The one which M. Amici thinks the best is shown in fig. 4, where A B C D is a piece of thick

Fig. 4.



parallel glass; F G H C, a metallic mirror, whose face, F G, is highly polished, and inclined 45° to B C. Rays from an object, M N, after passing through the glass, A B C D, are reflected from F G, and afterwards from the face, B C, of the glass to the eye at E, by which the object, M N, is seen at *m n*, where the paper is placed. The pencil and the paper are readily seen through the plain glass, A B C D. In order to make the two faces of the glass, A D, B C, perfectly parallel, M. Amici forms a triangular prism of glass, and cuts it through the middle; he then joins the two prisms, or halves, A D C, C A B, so as to form a parallel plate, and by slightly burning round the prisms, he can easily find the position in which the two faces are perfectly parallel.

A. D. M.

SUMMARY OF THE EFFECTS OF VARIOUS RAILWAYS ON THE AMOUNT OF INTERCOURSE.

By referring to our notes, A and B, it will be seen that on the Stockton and Darlington line, the passenger traffic, prior to the establishment of the railway, amounted only to 4000 persons in the year: it now exceeds 16,000. On the Bolton line the average weekly number of passengers is 2500; whereas the number of coach journeys out and in per week, which the railway has superseded, amounted only to twenty-eight, carrying, perhaps, on a weekly average, about 280 or 300 persons. On the Newcastle and Carlisle road, prior to the railway, the whole number of persons the public coaches were licensed to carry in a week, was 343; or, both ways, 686: now the average daily number of passengers by the railway, for the whole length, viz., 57½ miles, is 228, or 1596 in the week. The number of passengers on the Dundee and Newtyle line exceeds, at this time, 50,000 annually: the estimated number of persons who performed the same journey previous to the opening of the railway, having been 4000. Previous to the opening of the railway between Liverpool and Manchester, there were about 400 passengers per day, or 146,000 a-year, travelling between those places by coaches; whereas the present number, by railway alone, exceeds 500,000. In foreign countries the results arising from the same causes are equally striking. The number of persons who usually passed

by the road between Brussels and Antwerp, was 75,000 in the year; but since the railroad has been opened from the former place to Malines, it has increased to 500,000! and, since it was carried all through to Antwerp, the number has exceeded a million. The opening of a branch from Malines to Termonde, appears to have added 200,000 to the latter number; so that the passenger traffic of that railroad, superseding a road traffic of only 75,000 persons, now amounts to 1,200,000. It is remarkable that on this, as on most other railroads, the greater number of passengers are those who travel short distances, being as two to one compared with those who go the whole distance. This appears from a statement read by Mr. Loch, before the statistical society of Manchester, showing that between April 30th and August 15th, 1836, 122,416 persons travelled the whole distance, and 244,834 short distances, chiefly to and from Malines. He farther states, that "nearly one-third of the whole revenue of the railway is derived from travelling to and from Malines, and paying a fare of about sixty-six centimes, or nearly sixpence sterling." On the same authority we learn another fact most deserving of attention, in calculating the probable success of a railroad in such a country as Ireland, viz. that nearly three-fifths of the whole revenue of the company are derived from passengers of the lower class, paying a very low fare.—*Irish Railway Report.*

REVIEWS.

The Book of the United Kingdom. Written by Uncle John, for his Youthful Friends. Pp. 475. Darton and Clark.

TO OUR YOUNGER READERS.

Uncle John! Uncle John! Who is Uncle John? Why, if we may judge by his writings, he is akin to the juveniles' venerable and worthy friend, Peter Parley. This said Uncle John has just sent us a book, and asks us for our opinion of it; and our reply to Uncle John is, that if all he says of himself be true, he must be a mighty clever fellow,—if he be not, it surely must be his own fault, as, according to his own statement, he has had opportunities of obtaining knowledge which comparatively few persons possess. Upon opening his preface, we are saluted with the following:—

"I have been much *abroad*, but am always at *home* when I talk of what I have seen. And I hope you will find me at home, my little friends; indeed, I assure you I mean to make myself so, and you have only to tell me what part of my travels you would like me to detail to you. I have been all over Europe, Asia, Africa, and America; been up in a balloon, and down in a diving-bell; stood on the top of Chimboraza, and been to the bottom of the deepest coal mine."

Now we doubt not our young readers will agree with us, that this is saying a great deal; but when they come to see Uncle John's book, and to read the account of his various travels, adventures, and so forth, they will readily conclude that no one but an eye-witness could have given so clear and straight-forward a narrative. We have hastily glanced through the volume—which by the way is most prettily got up—and pitch upon the following as an illustration of the sentiments we have just advanced:—

"An ascent of Skiddaw was determined on by a party of whom I was one. The mountain is 3,500 feet from the level of the sea, and we began to ascend from Keswick. As we ascended, Derwent Water dwindled to the size of a pond, while the grandeur of its amphitheatre was increased by new ranges of dark mountains sublime from accumulation. We soon lost all traces of the flocks that were scattered over these tremendous wilds, and the guide conducted us by many curvings among the heathy hills and hollows of the mountains. The mountain soon again shut out all prospects but its own valleys and precipices, covered with various shades of turf, moss, and heath, of which a dark purple was the prevailing hue. Deep chasms and torrents surrounded us, foaming and shining amidst the dark rock. As we ascended, the air became very thin, and the steeps more difficult of ascent. About a mile from the summit the way was, indeed, dreadfully sublime, lying for nearly a mile along the edge of a precipice that gaped into a glen within the heart of Skiddaw, and neither a hill nor a bush interrupted its length through the whole distance. The ridgy steeps of Saddleback formed the opposite boundary of the glen; and although at a considerable distance, had, from the height of the two mountains, such an appearance of vicinity, that it almost seemed as if we could spring to its side. The hill in this part rose so close, as scarcely to allow a ledge wide enough for a single horse. After this the ascent appeared easy and secure.

Passing the skirts of the two points of Skiddaw which are nearest to Derwent

Water, we approached the third and loftiest, and then perceived that their steep sides, together with the ridges which connect them, were entirely covered, near the summit, with a whitish shivered slate, which threatened to slide down them with every gust of wind; the broken state of this slate makes the present summit seem like the ruin of others. The prospects that now burst upon us at every step were grand beyond description. At last we stood on a pinnacle commanding the whole dome of the sky, and the prospects below, each of which had before been considered separately as a grand scene, were now minute parts of the same landscape. On the north, in the grey horizon, might be discovered the Scottish mountains. The Solway appeared surprisingly near us, though fifty miles distant, and the guide said, that on a bright day the shipping might be clearly distinguished. Nearly in the same direction the Cheviot hills dawned feebly beyond Northumberland. Our sight now spanned the narrowest part of England, looking from the Irish Channel on one side, to the German ocean on the other; the latter was, however, so far off as to be discernible only as a mist. All individual dignity was now lost in the immensity of the whole, and every variety of character was overpowered by that of astonishing and awful grandeur.

The air on this summit was boisterous, intensely cold, and difficult to be respired, though the atmosphere below was warm and serene. In the descent it was interesting to observe each mountain below gradually re-assuming its dignity, the two lakes expanding into spacious surfaces, the many little vallies that sloped upwards from their margins recovering their variegated tints of cultivated lands, the cattle re-appearing upon the meadows, and the woody promontories changing from smooth patches of shade into richly tufted summits. About a mile from the top a great difference was perceptible in the climate, which became comparatively warm, and the summer hum of bees was again heard on the purple heath.

About three miles to the east of Skiddaw is Saddleback, a mountain 3,324 feet in height. It obtained its name from its shape, resembling a saddle. The same party who had the day before made the ascent of Skiddaw, determined to gain the summit of this mountain also. We started early in the morning, just as the sun was rising behind it; the base of this mountain is broken into a little world of mountains, green with cultivation; its north-west skirts unite with the declivities of Skiddaw, but its southern face is furrowed by several hideous chasms, and its summit is in many parts frightful and desolate. It appears to have been in a volcanic state at one time; and a lake on the upper part, called Threlkeld Tarn, whose bed is apparently the solid rock, is supposed, from the lava and burnt stones found in its neighbourhood, to have been a crater. This cavity is several acres in extent, and said to be so deeply situated in the bosom of the rock, that the sun never shines upon it. Its waters appear black, and are as smooth as glass. The views from the summit are exceedingly extensive; but those immediately under the eye, on the mountain itself, are so tremendous and appalling, that few persons have sufficient resolution to experience the emotions which these awful scenes inspire, and they are, therefore, but seldom visited. One of the points of the summit juts out between two gulphs, that seem to be more than 800 feet deep, having their sides craggy and barren, and their bottoms paved with broken rocks of various hideous forms and dimensions.

While we were enjoying ourselves on the top of this mountain with the grandeur of the scenery, our guide began to warn us of a coming storm, and advised us to quit the mountain. We saw no immediate signs of such an occurrence, and deferred our stay till the clouds advanced with accelerated speed, and the hollow blast sounded among the hills and dells which lay below, and seemed to fly from the approaching darkness. The vapours rolled down the opposite valley, and seemed to tumble, in mighty sheets and volumes, from the brow of each mountain into the vale of Keswick, and over the lakes. While we admired this phenomenon the clouds below us gradually ascended, and we soon found the summit of the mountain totally surrounded, while we looked down on every side on an angry and tempestuous sea of clouds heaving its billows. We were rejoicing in this grand spectacle of nature, and thinking ourselves fortunate in having beheld so extraordinary an event, when, to our astonishment and confusion, a violent burst of thunder, engendered in the vapour below, stunned our senses, being repeated from every rock and down every dell, in horrid uproar; at the same time, from the agitation of the air, the mountain seemed to tremble at the explosion. The clouds were instantaneously illumined, and, from innumerable chasms, sent forth streams of lightning. Our guide lay upon the earth terrified, and in his ejaculations accusing

us of presumption and impiety. Danger made us serious; we had nowhere to flee to for safety; no place to cover our heads; to descend was to rush into the inflammable vapour, from whence our perils proceeded; to stay was equally hazardous, for now the clouds which had received such a concussion from the thunder, ascended higher and higher, enveloping the whole mountain, and letting fall a heavy shower of rain. We thought ourselves happy under this circumstance, as we perceived the storm turning north-west, and heard the next clap in the plain a mile from us. The echoes from the mountains which border Keswick Lake, from Newland, Borrowdale, and Lodore, were noble, and gave repetition to the thunder claps distinctly, though distant, after an intermission of several seconds of intense silence. The rain, which still increased, formed innumerable streams and cascades, which rushed from the crowns of Skiddaw, Saddleback, and Coswey Pike, with a mighty noise; but we were deprived of the beauty of these waterfalls by the intercepting vapour, which was not to be penetrated by the eye more than a few yards before us. We descended the hill, wet and fatigued, and were happy when we regained our inn, at Keswick, which we now esteemed a paradise."

Arithmetical Tables. By JAMES CHILD. London: Edwards, Ave Maria-lane; Darton and Harvey; Simpkin and Marshall.

A USEFUL little book, well adapted for schools; it contains several tables which are not found in ordinary books of arithmetic, and is executed with great accuracy—a quality peculiarly valuable in a work of this kind, intended not only for the purpose of education, but for practical reference. It has arrived at the twentieth edition, which sufficiently indicates the share of public favour it has obtained.

An Improved Method of performing Commercial Calculations; representing the Science of Arithmetic in a New Light. By J. FELTON. London: Harvey and Darton, Gracechurch-street. 1839.

THE author's chief object appears to be the simplification and shortening of such calculations as are usually required in commercial transactions. Some examples of the abbreviated method compared with the work of the common system, are very striking; and we strongly recommend every accountant to peruse this valuable little volume, feeling confident that very few practical calculators will close the book without deriving at least some serviceable hints. It may be proper to remark, that the system taught in this work is not entirely new; many of the rules for abbreviation having been propounded by Wingate and others nearly a hundred years ago.

The Autobiography of Thomas Platter, a Schoolmaster of the Sixteenth Century. Pp. 106. Wertheim, Paternoster Row.

THIS little work is a translation from the German, and is rendered somewhat interesting by a series of wood illustrations, taken from the original prints.

MISCELLANEA.

Opening of an Ancient Barrow at Thornborough.—The following is given in the *Bucks Herald*:—On the farm belonging to the Duke of Buckingham and Chandos, near Thornborough Field, in this country, there are two ancient barrows, about 25 feet each in height. One of these has recently been opened under the direction of his Grace, and with the most gratifying results. The excavation was commenced last week by cutting a trench right down the centre; and by this operation it appeared that the barrow was composed of alternate layers of clay, sand, and mould, which continued until the trench was cut down to the original base—the level of the ground. On reaching this, a large and long layer of rough limestone presented itself, on which were found various bronze ornaments in an excellent state of preservation. Among them was a very curious lamp, beautifully shaped, formed of bronze, and totally different in pattern to any hitherto discovered—and so perfect, and taken up with such care, that the wick was actually to be seen in the lamp. Two large and elegant bronze jugs, a large dish, a bowl and the hilt of a sword, were also taken out without damage, as well as a small ornament of purest gold, with the figure of a Cupid, most elaborately and elegantly chased upon it. A large glass covered over with a thick piece of oaken planking was also discovered, but unfortunately, owing to the weight of the superincumbent earth, it was cracked and broken; but not so much so, but that within it were detected the ashes and fragments of the bones of the individual whose remains had been interred there for centuries. From the exquisite workmanship of these bronzes, and the hilt of a sword also found among the valuable and interesting relics of a by-gone age, it is conjectured that this was the *tumulus* of some person of great note and distinction. The excavation is proceeding, and no doubt but other valuable relics will be found, which, we trust, will afford the best means of judging of the date of the barrow; and thus add to the interest and value of these choice and peculiarly interesting specimens of an age, whose remoteness from the present time must be from 1400 to 1800 years!

Improvements in the Daguerreotype.—The French scientific men are very busy upon this discovery, in the proceedings of their Academy of Sciences. Baron Segnier has exhibited an instrument constructed by himself, with ingenious modifications,—having for their objects diminution in size and weight, and simplification in other respects of the entire apparatus. M. Segnier expressed himself satisfied, that several of the conditions which have been announced as required for the success of the process, may be dispensed with; and stated his intention of devoting himself to a still farther simplification of the apparatus, so as, at least, to make it more portable, more easy of use, and less expensive. His improvements have likewise been directed to rendering the operations of photography practicable in the open country, even those delicate ones, which seem at present to require protection against too strong a light.—M. Arago also laid before the Academicians an objective glass, constructed with the view of *redressing* the image obtained in the Daguerreotype, which is now presented *reversed*,—a circumstance that, in many cases, destroys the resemblance of places and monuments.

INSTITUTION.

LECTURES DUPING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Jan. 2, William Ball, Esq., on the different Styles of the English Ballad. At half-past eight.

QUERIES.

If among your mathematical correspondents anyone will give the solution of the following equations, I shall be greatly indebted.

J. J. B.

$$1st.—x^2+1+\frac{x\sqrt{x}+\sqrt{x}}{2}=\frac{11x}{2}$$

$$2nd.—(x+1)\,.\,(x^2+1)\,.\,(x^3+1)=30x^3.$$

Where can I purchase asphalte in small quantities? I should prefer Claridge's.

W. Scott.

A, a pedestrian, is benighted on a large plain, and observes a light bearing directly north from him, and which light is distant from him exactly one mile. The light is carried by B, travelling directly east, at the rate of three miles an hour; but A, erroneously supposing it to be stationary, keeps continually travelling towards it at the rate of four miles an hour. How long will he travel before he comes up with B, and what will be the distances travelled by each of them, from the time the light appeared? Also, required the nature and construction of the curve described by A's route? W. N.

ANSWERS TO QUERIES.

The Drummond Light.—"H. D. Chard."—The Drummond light is two jets of oxygen and hydrogen gases (mixed in the proportions for forming water) thrown on to a ball of lime put on to a wire, which is made to revolve by clock-work; by this means the lime becomes equally heated.

Th Bude or Gurney Light is an oil Argand lamp, with a jet of oxygen thrown up the centre. The commonest oil may be used; indeed the more smoky the oil burns in common, the better is the light. When the oxygen is made to pass through the flame, the oxygen strikes the nascent carbon and vapour of the oil, and produces an intense light. A reflector is generally used.

Juvenile Entertainer.

To make Green Ink.—Mix the solution of sulphate of indigo (the process for making it I have already described) with a decoction of French berries or fustic wood, and then dissolve gum-arabic in the mixture. J. Mitchell.

TO CORRESPONDENTS.

F. V. E.—"*Pounds, shillings, and pence cannot, from their nature, be multiplied by pounds, shillings, and pence, any more than an oak table can be made of deal boards;*" *so says our correspondent, and we agree with him, without any reservation. Multiplication is, in fact, nothing more than an abbreviated method of addition, in cases where the sums to be added are all alike and equal, or fractions of some given quantity; no operation of multiplication can, therefore, be performed without an abstract number, to prescribe the number of times the quantity to be multiplied is to be taken, or how many, and what fractional parts thereof are to be added together. To multiply a penny piece by half a crown, is in no degree more rational than multiplying the poker by the tongs, or a pound of common sense, by a yard of Treasury minutes. This is one of the many examples which might be adduced to show the value and the necessity of accurate language in all matters connected with mathematics. Those who have any knowledge of simple arithmetic, must be perfectly aware that one thing cannot be multiplied by another which represents no number. The meaning of those who speak of multiplying* 19*l.* 19*s.* 11¾*d. by* 19*l.* 19*s.* 11¾*d. (if they mean anything at all), is this:*—"*Multiply* 19*l.* 19*s.* 11¾*d. by* $19\frac{959}{960}$"—*a very different question from the former, and may easily be solved by the ordinary process of multiplication, thus;*—

$$19\frac{959}{960}=\frac{19199}{960}\times\frac{19199}{960}=\frac{368601601}{921680}=$$

$$£399.19.2—\frac{1}{960}.$$

T. P., W. W., *and* D. J., *shall be answered in our next.*

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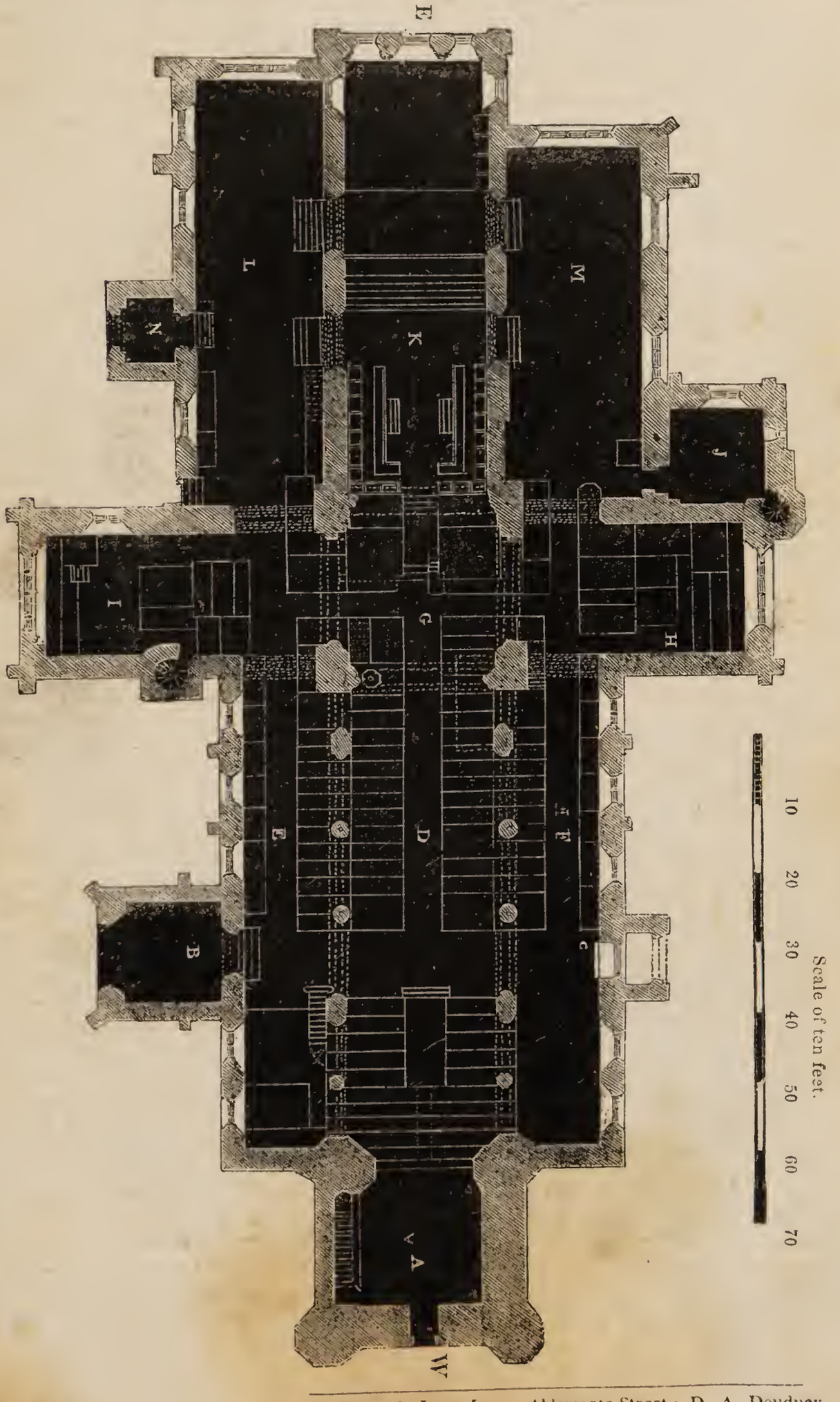
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 69, NEW SERIES. | SATURDAY, JAN. 4, 1840. PRICE ONE PENNY. | No. 190, OLD SERIES.

GROUND PLAN OF WIMBORNE MINSTER.



VOL. V.—No. 20]

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

THE PENNY POSTAGE.

On the 10th of the present month (January), the long wished-for and fought-for uniform penny postage will be established throughout the United Kingdom. This great and enlightened measure has been opposed by a portion of the press; and we have witnessed with regret and surprise the course pursued by some of the most influential papers of the day, who, from motives which they have endeavoured to conceal, have set themselves in array against a project of incalculable public benefit, and opposed a vain resistance to the firm determination of nine-tenths of the nation; but to those who have energetically and triumphantly advocated the good cause, we beg in the name of that considerable and respectable portion of the public with whom we have the honour of holding communion, to tender our thanks for the signal service they have rendered to society. We also perceive with much satisfaction, that the voice of "The Mechanic" has found numerous echoes in contemporary publications; the "Morning Advertiser," having previously reproduced an article from this work, has the following in the publication of Friday se'nnight as a leading article:—

"We yesterday inserted a well-written article from "The Mechanic and Chemist," which, though humble in price, is a periodical of merit on the subject of the Penny Postage. In that article the writer clearly exposes the absurdities of the existing arrangements, and confidently maintains, that if the universal penny postage only once receive a fair trial, it will prove successful in every point of view, not even excepting its financial bearings. We have some doubt whether the same amount of revenue will ever be derived from a penny postage as the recent system yielded; if it does at all, it is clear it will not for some time. But any deficiency of revenue, whether the amount be great or small, which may be consequent on the adoption of the penny postage, is a consideration which ought not to weigh a feather when put in the balance against the individual and social benefits of which the measure will necessarily be productive. We feel assured, that the most sanguine mind has not as yet formed any adequate conception of the immense advantages which will result to the community from its adoption. It will foster and elicit the better feelings of human nature; it will call forth the latent sympathies which exist between man and man; it will draw closer and closer the tender ties of affection on the part of one relative to another; it will strengthen union among friends; it will bring heart into close and cordial contact with heart; it will increase to an inconceivable extent the facilities already existing for the mental and moral improvement of the poorer classes of society; and thus diffuse abroad, through the length and breadth of the land, blessings of unspeakable magnitude."

The system as at present prescribed by the Treasury, is still defective in some respects; but the grand object is attained, and letters will be conveyed from one corner of the kingdom to the other for one penny, provided they be pre-paid, and do not exceed half an ounce in weight.

WIMBORNE MINSTER.

(From a Correspondent.)

The following description of the collegiate church of St. Cuthberga, Wimborne Minster, Dorset, is extracted from a work just published by H. Herbert, Wimborne. It contains magnificent views of the exterior and interior of the Minster, drawn and engraved by N. Whittock.

"The exterior of this ancient structure has been greatly injured by injudicious repairs and alterations made at various periods of time. The eastern window is formed by three lancet-headed lights, with ornamented divisions; but the exterior does not present that peculiar construction which will be found in the interior. The arches below the window were intended to give light to the crypt. The window of the side aisle is light and elegant, but in a much later style of architecture than the window of the choir. The northern entrance to the church is from a modern porch. The windows of the choir and side aisle are of various forms. The roof is leaded. The window of the north transept is large but ill-shapen; and, from the taste and judgment displayed in the recent repair and restoration of the interior of the church, we may anticipate that it will, at no distant period, be removed. The central tower is the most ancient and beautiful part of the exterior of the Minster; it springs from the intersection of the nave and transepts. The roof of the north transept has been considerably lowered. Traces of the height of the original roof may be seen on the northern wall. Above the gables rises the first story of the tower: it contains two circular headed Norman windows, between which is a blank-pointed arch; the whole are connected by

a dripstone, and ornamented by slender shafts with carved capitals. The second story contains seven semicircular arches, which intersect each other, forming pointed arches at their intersections: a bold ornamented tablet enriches the arches, which are also ornamented with shafts having sculptured capitals. The arch in the centre is pierced to admit light to the interior of the tower; the cornice above is supported by blocks of stone resembling beam-ends; it encloses sculptured heads at each angle. The battlements and pinnacles were added to the tower after the fall of the spire, and do not at all contribute to the architectural beauty of the building. The angles of the tower below the parapet are broken by slender shafts divided by bands. The roof of the nave is leaded. The five clerestory windows of the nave appear square-headed in the exterior of the building; they are in the perpendicular style of architecture, but are nearly hid in this view by the projection of the transept. The porch leading to the nave is entered from a pointed arch. The gable is lofty, and contains a window, which affords light to the record room.

The western tower was erected about 1460, and has the symmetry and chaste ornament which characterized the building at the close of the fifteenth century. The

lower is one hundred feet high, and is divided into four stories. The pinnacles, which are rather too low for the tower, are ornamented with crockets and finials. The western wall of the tower originally contained an elegant doorway and window, both of which requiring repair, were entirely removed in 1739, and the present oval window and heavy doorway supplied their places. The dripstone of the original window still remains, the space between that and the moulding round the oval being plastered up. The belfry of this tower contains six bells; the great bell, originally dedicated to St. Cuthberga, and called after her name, was re-cast in 1689; it weighs 36½ cwt.

The porches and windows of the south side of the Minster are in much better preservation than on the north. The centre tower is seen to great advantage in this view. The circular turret at the angle formed by the walls of the nave and transept, encloses a staircase which leads to the library. The large window in the south transept has been beautifully restored, and is an elegant specimen of modern Gothic architecture."

This church contains many curious relics of antiquity, and other interesting objects:—

"Beneath an arch on the north side of the choir, is a plain altar tomb of grey marble, bearing the remains of a brass inscription along the verge:—'- - - Conjux quondam Henrici Courtenay Marchionis Exon et mater Edwardi Courtenay nuper Ao. - - - -' This tomb was erected for Gertrude, the second wife of Henry Courtenay, Marquis of Exeter, and mother of Edward Courtenay, Earl of Devonshire, who died in 1556. The space above this tomb will shortly be decorated with stained glass, executed by Willomet, by the command of the Earl of Devon. (See engraving, page 145.)

Beneath a newly-constructed gallery is a curious old orrery, connected with the works of the clock, showing the age and phases of the moon, the revolution of the planets, and the situation of the sun, according to the Copernican system of astronomy."

The engraving (front page) is the ground plan. The length of the church from east to west, measured externally, is 200 feet.

"A, the western tower, showing the stairs to the gallery.
B, the northern porch.
C, the southern porch.
D, the nave; length 70 feet, breadth 27.
E, F, side aisles to the nave; 70 feet long, 13 feet wide; making the width of the church in the interior, 53 feet, exterior 60 feet.
G, the central tower; each side of the square measuring 31 feet, including the piers.
H, south transept; 33 feet long, 19 feet wide.
I, north transept; 40 feet long, 19 feet wide.
J, the vestry; 16 feet by 14 feet.
K, the choir; length 65 feet, breadth 21 feet. The length from the centre tower to the top of the steps leading to the altar, is 33 feet; from the steps to the eastern wall, 32 feet.
L, north side aisle to choir; 62 feet long, 21 feet wide.
M, south side aisle to choir; 54 feet long, 20 feet wide.
N, north-east porch."

THE CHEMIST.

THE ELEMENTS AND THEIR COMBINATIONS.

To the Editor of the Mechanic and Chemist.

SIR,—Having described oxygen, I will proceed to chlorine. Chlorine was discovered by Scheele in 1774. He called it *dephlogisticated acid*. The term *oxymuriatic acid* was afterwards applied to it by the French chemists. The more appropriate term *chlorine* (from χλωρος) which merely designates its colour, was given to it by Sir H. Davy. To obtain this gas, a mixture of equal weights of black oxide of manganese and hydrochloric acid are heated over a lamp in a glass retort. Chlorine is copiously evolved, and may be collected over warm water. It is absorbed by cold water, and therefore cannot be long retained over that fluid; so that it should be received into bottles provided with ground stoppers previously greased a little. It may be procured from a mixture of eight parts of common salt, three of pulverized black oxide of manganese, four of water, and five of sulphuric acid. Chlorine at common temperatures and pressures, is a permanently elastic and gaseous fluid; but by subjecting it to a pressure of about four atmospheres, and at the temperature of 60°, Professor Faraday condensed it into the liquid form. It has a pungent and disagreeable smell, and is highly injurious when respired. Its colour is greenish yellow. The specific gravity of chlorine, compared with hydro-

gen, is as 36 to 1; with atmospheric air, its specific gravity is as 2.500 to 1.000. The specific gravity of liquid chlorine is about 1.330. At a temperature of 60°, water dissolves two volumes of chlorine. The solution is of a pale yellow colour, has an astringent nauseous taste, and destroys vegetable colours. It is a powerful antiseptic and destroyer of contagious and infectious matter. Many bodies, such as phosphorus and several of the metals, are spontaneously ignited by chlorine, and burn in it with much brilliancy. In these cases binary compounds result, which are termed chlorides. Brass or copper leaf, and powdered antimony, serve well to show the action of chlorine on certain metals. When introduced into the gas, they enter into immediate combustion, and chlorides of copper and antimony are formed.

Chlorine and Oxygen.—Chlorine and oxygen unite in four proportions, forming two oxides and two acids.

The protoxide of chlorine consists of	36 parts	chlorine +	8 oxygen.
Peroxide	36	— +	32
Chloric acid	36	— +	40
Perchloric acid	36	— +	56

Protoxide of chlorine was discovered by Sir H. Davy, and in consequence of its deep yellow-green colour, he gave it the name of *euchlorine*. It is easily absorbed by water, and must therefore be collected over mercury; but that metal gradually decomposes it, so that it cannot long be retained in contact. To obtain protoxide of chlorine, introduce into a retort two parts of chlorate of potassa, and pour upon it one part of concentrated hydrochloric acid, previously diluted with one part of water; apply a very gentle heat, so as to occasion a moderate effervescence. This gas is very pernicious to respiration. Its specific gravity compared with air is as 2.44 to 1.000. Water dissolves ten volumes of this gas, and acquires its peculiar odour and colour. It destroys vegetable colours, previously reddening some of the blues. Its most remarkable character is the facility with which it is decomposed; when gently heated in the upper part of a small tube, standing over mercury, a kind of explosion, attended with a flash of light, ensues, and the tube is projected to some distance. This gas sometimes explodes while it is collecting, or in being transferred from one vessel to another, or even by the heat of the hand; so that it should be cautiously dealt with, and examined and collected in small quantities only.

Peroxide of chlorine is obtained as follows:—About 50 grains of chlorate of potassa are moistened with a few drops of sulphuric acid, and rubbed together with a platinum spatula, till they incorporate and form a solid mass of an orange colour. This mass is to be introduced into a small glass retort, and gradually warmed in a water-bath, the temperature of which must be carefully kept below 212°, which may be managed by mixing alcohol with the water. A bright yellowish-green elastic fluid passes off, which is rapidly absorbed by water, but may be collected in small tubes over mercury. The colour of this gas is more brilliant than that of the protoxide, and its odour more aromatic. Its specific gravity, compared with air, is as 2.360 to 1.000. It requires the same and even greater precautions in preparing and transferring, than the former gas. Its saturated aqueous solution is of a deep yellow colour; an astringent and corroding taste. It destroys vegetable colour.

Chloric acid I have described in my papers on the acids.

Perchloric acid is procured by distilling perchlorate of potassa with its own weight of sulphuric acid, diluted with a fourth part of water, at a temperature of about 280°; white vapours pass off, which condense in the form of a colourless liquid. It does not exist independent of water or a base.

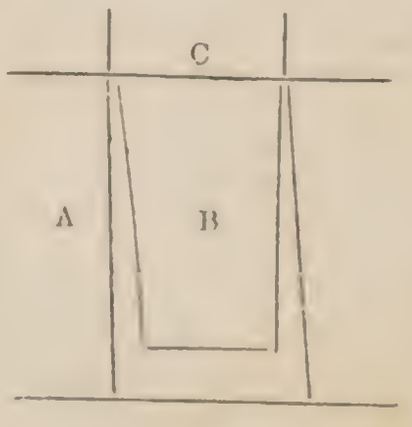
J. Mitchell.

POROUS JARS FOR GALVANIC BATTERIES.

To the Editor of the Mechanic and Chemist.

Sir,—A short time since, being in want of a few porous jars for a small set of galvanic batteries I was then constructing, I applied to a philosophical instrument maker for the purpose of procuring them, when I found the prices asked were sixpence and eightpence each, and which I thought rather extravagant, so I determined not to submit to it, and set myself thinking how I could avoid it; at last I hit upon a plan which answers perfectly, and so exceedingly cheap, that I can make the size I want for sixpence a dozen. The manner in which I make them is this:—I first form a mould by coiling up a piece of sheet tin (such as saucepans are made of)

the size I want. The size I have made is three and a half inches high, and two and a quarter inches diameter. For the above, I make the coil a little higher than I wish the jar to be. I then coil up another piece, so as to fit into the former, leaving little less than the fourth of an inch between the two; the inside coil must taper slightly towards the bottom, so as to facilitate the extraction of it after the jar is made. To form the bottom of the jar, I pass a wire transversely through the centre piece of the mould at a certain height from the bottom of it, so as to leave a space of whatever thickness I wish at the bottom of the jar. I also put a piece of tin or wood at the bottom of the centre piece, so that the composition of which I form the jars, may not fill the centre also. I then weigh out a quarter of a pound of plaster of Paris, and mix it up with three ounces of water. I have also coloured the jars the same as those sold at the shops, by mixing with the plaster some Armenian bole; but before pouring the plaster into the mould, I oil it; I then place the outer piece on a flat surface, so that when the liquid plaster is poured into it, it may not escape. I then introduce the centre piece evenly, so as to form the sides of the jar of equal thickness. In about ten minutes the plaster will be sufficiently hard to allow the centre piece to be taken out. I then open the outside of the mould and allow the jar to slip out. It may then be finished by cutting off the superabundant plaster round the edges. But as all porous jars when wet have a tendency to fall to pieces, I cut a slip of thin sheet copper, about half an inch wide, and coil it round the top of the jar, lapping the ends over, and making them fast with a pair of pliers, thereby forming a surface to lay hold of, without incurring the risk of breaking the jar. In order to render the operation more clear, I here give a sectional drawing of the mould :— A is the outer coil; B, the centre piece;



C, the wire to prevent its sinking too low, to form a bottom. Hoping this will be of service to your readers, I remain, &c.,

J. Mitchell.

SHEFFIELD MECHANICAL AND CHEMICAL SOCIETY.

To the Editor of the Mechanic and Chemist.

Sir,—In one of the numbers of your useful Magazine, "Tyro Chemicus" proposed a society for the study of practical mechanics and chemistry; and you kindly offered to notice the proceedings of such societies. I have no doubt, you as well as Tyro Chemicus, will be very glad to hear of one being established. I had often thought that such a society would be beneficial; but there was a great difficulty in getting a sufficient number of young men to persevere. It was with much pleasure that I read the proposal, and I immediately named it to a few friends, who were fortunately of the same opinion. The first meeting, consisting of five, was held on the 22nd of November; when the following rules were adopted: (perhaps they may be of use to others in the same situation)—

1. The object of this society is the advancement of its members in the arts and sciences.

2. That every member in turn shall read a paper; or, on neglect of so doing shall incur a fine of 6d.

3. That political and religious subjects be not introduced, either in papers or discussions.

4. That the meetings of this society be held every Wednesday evening, at eight o'clock; when a memorandum shall be made by the secretary of the proceedings.

5. That each member deposit —— per month into the hands of the secretary at the close of the meeting, and that the forfeit for non-payment or non-attendance, unless in cases of necessity, be —— per week; and also, that all members neglecting to pay for the space of six weeks, shall be excluded or fined.

6. That a secretary be elected every six months, who shall also hold the office of treasurer.

7. That the funds of this society shall be expended in apparatus or books, as the majority may deem fit.

8. That any member may propose a friend wishing to become a member, whose name shall remain in the proposition lists for three successive meetings, when he shall be admitted by a majority.

9. That any member breaking the above rules, shall be excluded or fined, as the society shall deem fit.

On account of the approaching holidays, the meetings are postponed till Christmas, when it is proposed to have a social tea-party, to be continued yearly. I think that communications of newly-invented machines, discoveries, or new and important papers from one society to another, would be very advantageous to both: and, as the postage is about to be so very low, it will be very practicable. Any information from Tyro Chemicus as to what manner the society in London is conducted, will be very thankfully received. Papers have already been read on attraction and electricity. We amount to 9 at present.

I remain yours, &c.,

W. E.

N.B. Any letter addressed to William Ellis, Infirmary Road, Sheffield, and left at No. 54, Wych Street, Strand, will find the secretary.

[We feel peculiar pleasure in recommending this letter to the consideration of our readers, and, as far as the limits of this work will permit, we shall be happy at all times, to forward the views of all such highly praiseworthy institutions. But another description of assistance, of more direct and immediate advantage, is required to render a society of this kind, effective and permanent. That assistance it is out of our power, or, at least, out of our province to supply; but a suggestion from a publication of unquestioned integrity, and sober honesty of purpose—a publication whose very existence is dependent upon that good order and tranquil contentment in society which it endeavours and tends to promote—such recommendation, if it does not produce conviction of the goodness of the cause for which we plead, and consent to the proposals which we submit, will at least be a convenient and advantageous mode of making known the existence, intentions, and wants of the society. It is a goodly sight to see a company of young men renounce the foul-mouthed demagogue, and the alluring libertine, to cultivate useful arts, and found the edifice of their future lives, on the solid rock of knowledge and respectability; and it is not only the duty, but the interest of every good citizen who has "a stake in the country" to encourage and assist them.

Discretion forbids us to mention names; but we know that there are many opulent, enlightened, and liberal men in Sheffield, and we will venture a prediction that they will not refuse the assistance of a little pecuniary gift towards the purchase of books and instruments, the first necessity of mechanical and chemical associations.—It is proper to state that it is not at the request, or with the knowledge of the society that we are induced to make this appeal; but solely from a conviction that it will accelerate the accomplishment of their object, and probably promote the formation of other societies of a similar nature.—Ed.]

QUERIES.

The best way for making the different sorts of paste for fishing? Also a description of the general fishing instruments; as also how to make artificial flies? W. Conquest.

The best means of converting soft water into hard; or the most permanent manner of impregnating it with limestone, sulphate of lime, or any other and better material that will produce a wholesome hard water in large quantities?

W. L. Lizard.

How, in the preparation of oxygen gas from saltpetre, the nitrogen which is produced is to be separated? 2. Could the nitrogen by any means be separated from the air, as to leave the oxygen? 3. How to procure cyanogen gas from a less expensive material than cyanuret of mercury? 4. What colourless varnish can be applied to paper, so as to leave it perfectly flexible? F.

ANSWER TO QUERIES.

Parasol rings are not made from a composition, but are turned out of horses' leg bones.

To make Yellow Fire.—Use nitrate of soda, mixed with sulphate of potass and sulphur. The proportions I do not know, but they are very easily determined by experiment. F.

To separate Metal from the Dross.—"J. S. B." The dross which accumulates on the surface of lead when in a state of fusion is an oxide, produced by the action of the oxygen of the air; which has the property of combining with that metal at high temperatures. It may be easily reduced to the metallic state, by mixing it with half its weight of powdered charcoal, and exposing it in a crucible to a red heat until the reduction is complete. A wind-furnace would be the best for this operation; but a common fire, with the assistance of a pair of bellows, is quite sufficient for the purpose, except where a large quantity of the dross is required to be reduced. The reduction will be more complete if the crucible has a cover to it, with a small opening for the carbonic acid gas (which is formed during the operation) to escape; by this means the oxygen of the air will be prevented from acting on the reduced metal. A. Taylor.

Expansion of Water.—"D. J." The expansion of water, both by heat and cold, is, we think, an apparent rather than a real anomaly, though we have never met with any attempt at an explanation. Its maximum of density, as determined by the careful experiments of Dalton, is 42.5 Fahr.

Heated above, or cooled below this point, its bulk increases; and, by a singular arrangement, the dilatation is the same for the same number of degrees, upwards or downwards. All bodies which, by cooling, assume the form of crystals, expand in passing into the solid state; from which it should seem that *they* also have a maximum of density; but that the range between the point indicating this maximum of density, and that marking their temperature at the moment of solidification is so small, as hitherto to have remained unmeasured. Crystallization is the arrangement of the particles of a body in a determinate form, under the pressure of the atmosphere. This arrangement, it is evident, can be effected only by some previous motion, or turning about of the disintegrated particles in a fitting direction, which motion may be either sudden or progressive. If sudden, then the points marking the temperature of a liquid on reaching its greatest density, and that at the instant of solidification, must nearly coincide, and the difference may, therefore, be incommensurable; but if it be progressive, as we take it to be in the case of water, then the motion preparatory to crystallization commences when the temperature falls to 42.5, and goes on gradually increasing down to 32; by which time the particles have arranged themselves into the position proper for congelation, when the simultaneous pressure of the atmosphere wedges them into a mass, and the crystal, or ice, is the visible product. If this theory be correct, then, as a corollary, 42.5 is the lowest point at which water remains perfectly fluid. W. W.

Query.—"What will be the thickness of metal required for a concave copper ball eight inches diameter without, so as to sink to its centre in common water?" I am afraid that the solution given to the above query by "W. W." in page 77, will be too difficult for many of your readers, and I therefore forward you the following:—A cubic foot of common water weighs 1000 ounces, and a cubic foot of copper weighs 8878 ounces. The solid contents of a sphere, or ball, is equal to its diameter multiplied by .5236. Hence, $\frac{8^3 \times .5236}{2} = 1310416$, the contents in inches of half the sphere = the quantity of water displaced. And, as 1728 (inches in a cubic foot) : 1000 ounces : : 134.0416 inches : 77.57 ounces, the weight of the displaced water. Also, as 1728 inches : 8878 ounces : : 268.0832 (the contents in inches of the whole sphere) : 1377.34 ounces, the weight of a solid copper sphere of eight inches in diameter, from which being subtracted the before mentioned 77.57 ounces, there remain 1299.77 ounces, the weight of a sphere of copper equal to the vacuity of the ball. Then, as the solid contents of spheres are in proportion to the cubes of their diameters, we say,—As 1377.34 : 8^3 (=512) : : 1299.77 : 483.164, the cube root of which (=7.847) subtracted from 8 inches, there remains .153 for the difference between the diameter of the vacuity and that of the sphere, one half of which (=.0765, or nearly one-thirteenth of an inch, and corresponding nearly with the quantity found by "W. W.") is the thickness of the metal of the concave copper ball required. W. N.

The Wine Question.—Putting x the original quantity, it may readily be shown, that the portion left after the 5th operation will be $\frac{\overline{x-12}^5}{x^4}$ which, by the question, is to be = 54. A few trials will show that the value of x in this equation between 101 and 102.

Now $\frac{89^5}{101^4} = 53.661$ and $\frac{90^5}{102^4} = 54.552$

Then .891 : 1 : : .339 : .38.

Hence we have 101.38 for the original quantity.

Assume again 101.38 and 101.39;

Now $\frac{89.38^5}{101.38^4} = 53.99$ and $\frac{89.39}{101.39^4} = 54.008$.

Then .018 : .01 : : .01 : .0055.

Hence we have 101.3855 for the original quantity.

More assumptions would carry it nearer the truth, but this is sufficiently accurate. "T. S. R." has failed in answering it, from making use of *single* position, which, of course, does not apply in cases of involution In answering the question, as we did, the week after it was proposed, only that the letter failed in reaching its destination (see page 126), we supposed the proposer, "B. C." to mean only four operations; if such were his intention, then

$\frac{\overline{x-12}^4}{x^3} = 54$ where x lies between 93 and 94;

Then $\frac{81^4}{93^3} = 53.51$ and $\frac{82^4}{94^3} = 54.43$.

Now .91 : 1 : : .49 : .53.

Hence we have 93.53 for the original quantity. That this is sufficiently near is easily shown, for

$$\frac{81.53^4}{93.53^3} = 54.0028.$$

More assumptions would, of course, carry it nearer. W. W.

TO CORRESPONDENTS.

Engine.—*We should recommend, as the best shape, a cylinder with convex ends; the lamp should be placed in the centre, extending longitudinally, as nearly as possible, to the ends. There must, of course, be tubes to introduce the water, and to allow the escape of the steam. In locomotive engines, boilers have been adopted, composed of iron tubes, connected together by smaller tubes, or flat chambers, in the shape of the cover of a book, with the leaves taken out.*

Sherwood.—*If he will repeat his former queries in his next communication, they shall be attended to.*

Electron *will receive a letter by post; and,* if nothing occurs in the interim to alter our determination, *his last communication will be commented on in our next.*

Tyro Chemicus *will find a letter addressed to him at our office.*

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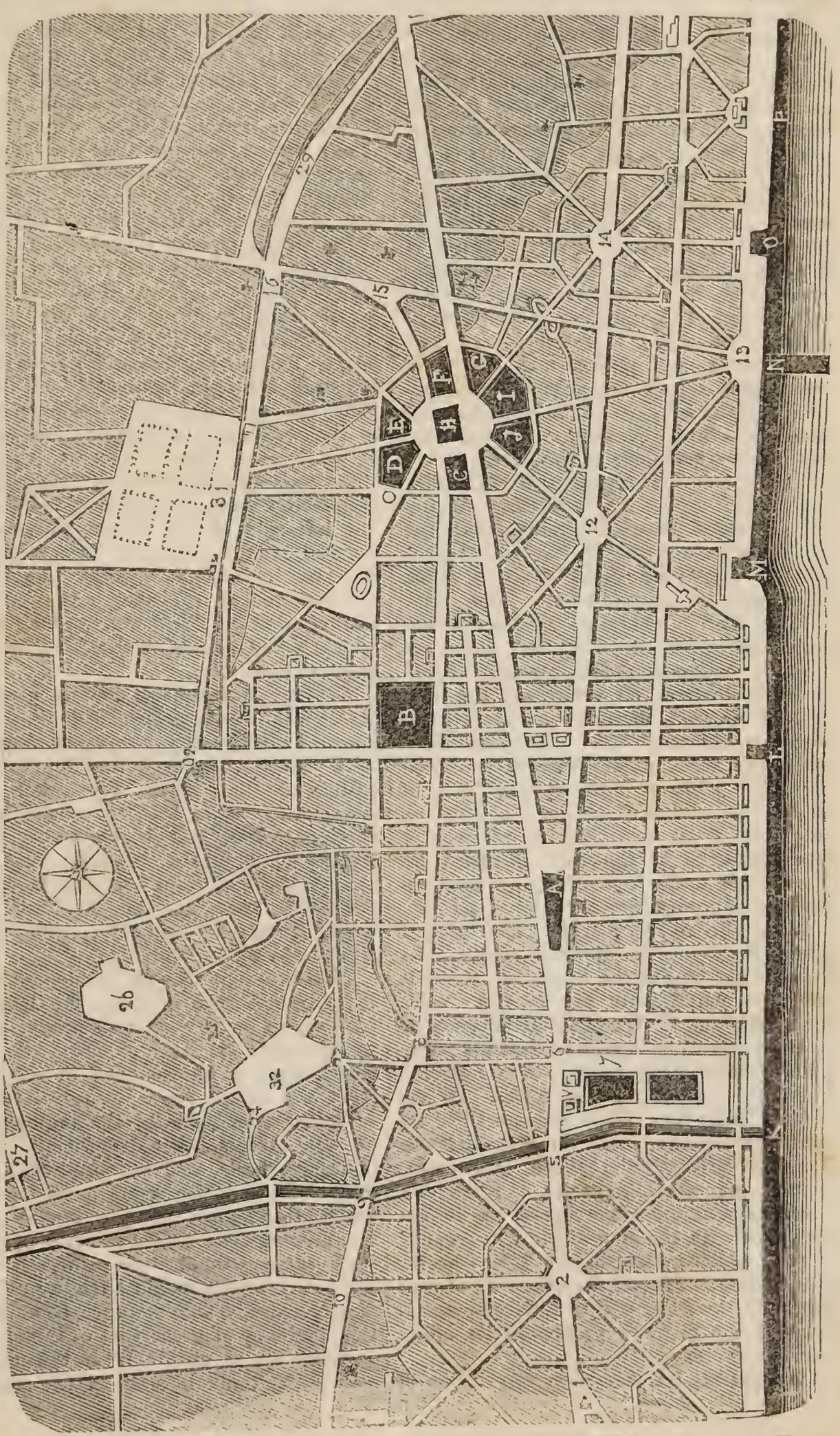
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 70, NEW SERIES. | SATURDAY, JAN. 11, 1840. PRICE ONE PENNY. | No. 191, OLD SERIES.

SIR CHRISTOPHER WREN'S PLAN FOR REBUILDING LONDON.



VOL. V.—No 21]

City Press, 1, Long Lane, Aldersgate Street; D. A. Doudney.

tages, who had left home to spend their Christmas Eve, found, to their great astonishment on their return, no other vestiges of their dwellings but those presented by the roofs and chimneys discernible above the chasms in which their habitations were engulphed. The new road from Charmouth to Lyme is utterly destroyed. The visitation, beside the destruction of property, has occasioned great alarm and anxiety among the owners of buildings and estates in the vicinity.' Multitudes of persons, from all parts, have been for several days past rushing into Lyme, Seaton, and Charmouth, eager to ascertain the nature and extent of the catastrophe. The total loss of property is estimated at 6,00 *l.* The cliffs on the coast do not appear to have suffered any disruption, all the mischief being inland.—*Taunton Courier.*

ON THE CIRCULATION OF THE BLOOD.

[The following interesting and instructive Lectures were delivered before the pupils at Miss Turk's school, Walworth, Nov. 1838, by Mr. J. S. Dalton. They have not been published before, and we feel obliged to the author for selecting this work as the medium of their first appearance.]

Having been requested to deliver before you a short course of lectures on the "Principles of Physiology," I propose, if you please, this evening to commence, by bringing under consideration the principal phenomena connected with the circulation of the blood. Physiology is a subject which so seldom engages the attention of ladies, more particularly as a branch of necessary education, that I feel it will be advisable for me to preface the lecture with a few observations, showing how foolish and injurious the prejudice has been, which would prevent you becoming acquainted with those natural laws, on which depend the preservation of health, and the enjoyment of that happiness, which cannot be secured without it. I trust I shall be able to do this in a manner which will prove to you, that there is nothing either unpleasing or offensive in this kind of knowledge when properly brought before you, but that, on the contrary, it abounds with instances of the most beautiful applications of science, and of mechanical contrivances, which cannot be contemplated without advantage and pleasure. I am aware that many persons consider it is quite unnecessary that ladies should acquire this kind of information, and it is so indelicate that it should be entirely excluded from their education; but the importance of it, more particularly to ladies, I will prove to you by a short extract from the work of a celebrated physician, "The Principles of Physiology, applied to the Preservation of Health, by Dr. Andrew Combe;" and I will leave you to judge for yourselves, after the conclusion of the lecture, whether there is anything in the slightest degree indelicate, or, indeed, calculated to offend the most fastidious delicacy, in the language or the diagrams which I shall use to explain the "Circulation of the Blood," the principal subject for our consideration this evening.

With regard to the importance of physiological knowledge, or a knowledge of the laws on which our health depends, Dr. Combe observes, "It has been objected, that to teach any one how to take care of his own health, is sure to do harm, by making him constantly think of this and the other precaution, to the utter sacrifice of every noble and generous feeling, and to the certain production of hypochondriacal peevishness and discontent. The result, however, is exactly the reverse; and it would be a singular anomaly in the constitution of the moral world were it otherwise. He who is instructed in, and familiar with, grammar and orthography, writes and spells so easily and accurately, as scarcely to be conscious of attending to the rules by which he is guided; while he, on the contrary, who is not instructed in either, and knows not how to arrange his sentences, toils at the task, and sighs at every line. The same principle holds in regard to health. He who is acquainted with the general constitution of the human body, and with the laws which regulate its action, sees at once his true position when exposed to the causes of disease, decides what ought to be done, and thereafter feels himself at liberty to devote his undivided attention to the calls of higher duties. But it is far otherwise with the person who is destitute of this information, uncertain of the nature and extent of the danger, he knows not to which hand to turn, and either lives in the fear of mortal disease, or, in his ignorance, resorts to irrational and hurtful precautions, to the certain neglect of those which he ought to use. It is ignorance, therefore, and not knowledge, which renders an individual full of fancies and apprehensions, and robs him of his usefulness. It would be a stigma on the Creator's wisdom, if true knowledge weakened the understanding, and led to inju-

rious results. And accordingly, the genuine hypochondriac, whose blind credulity leads him to the implicit adoption of every monstrous specific, is not the person who has gained wholesome knowledge by patient study in the field of nature; but he, and he alone, who has derived his notions of the human constitution, and of the laws of nature, from the dark recesses of his own crude imagination. Those who have had the most extensive opportunities of forming an opinion on this subject from experience, bear unequivocal testimony to the advantages which knowledge confers in saving health and life, time and anxiety. Thus Dr. Beddoes, in alluding to the delicate constitutions of females of the higher ranks in this country, remarks, *that he cannot "conceive how they can be rendered more hardy, or less nervous, if that term is preferred, otherwise than by being seasonably taught the principles of self-management,"* and adds, that he specifies the *principles*, "because little good can be expected, unless we proceed, as in other instances, where we exhibited to sense that connexion between cause and effect, which constitutes the order of nature.

It is my intention on the present occasion, and in the future lectures I shall have the pleasure of delivering here, to act on the excellent advice of Dr. Beddoes, and, by explaining "the principles of physiology, enable you to understand the more important operations of the animal economy, and, I trust, excite such a desire of knowing more of the subject, as will induce you to refer to some of the many excellent treatises that have been published on this subject, principally for the instruction of ladies, and which I shall subsequently allude to more particularly.

"The circulation of the blood," is the term used to explain that wonderful action which is constantly going on within us, by which the blood is propelled from the heart over the whole body, and returned again to the point from which it started, after performing the many important offices required of it in its passage. Before describing how the blood circulates, it will be well, perhaps, for me to describe briefly a few of the important offices it performs during its circulation, both because they will best illustrate the importance of a knowledge of the subject, and also because they will inform you how surpassingly wonderful are many of the processes constantly going on in our systems, of which most persons are completely ignorant.

The first use of the circulation is to supply the vital fluid to the different organs of the body, so that the latter may be adequately nourished,—that the loss of substance which is continually occurring may be renewed—and that the various structures may receive a sufficient supply of nourishment to enable them to increase in size as they may be required, and to remain in a state of health.

It is a well-ascertained fact, though it may not perhaps be popularly known, that our bodies are not the same any two moments together. We are continually changing, and our bodies of to-day probably do not contain a single particle of the substance of which they were composed some six or seven years ago. In fact, as far as our bodies are concerned, we are entirely different individuals; and as the change is continually taking place, we are not really the same persons to-day that we were yesterday, or even that we were when I commenced this lecture. When Hamlet exclaimed,

> "Oh that this too, too solid flesh would melt,
> Thaw, and resolve itself into a dew,"

he was not aware that the process was really taking place, though not quite so rapidly as he desired. Yet such was the fact, and the rapidity of the action, considering that we are quite insensible of it, is indeed surprising. The loss of the body in substance is principally by *perspiration;* not that kind of perspiration alone which has been so emphatically characterized in Holy Writ, as "the sweat of the brow" (or as a polite Frenchman termed it, "the perspiration of the eyebrows"); this is called *sensible perspiration.* But there is another kind, by which the body sustains a still greater loss of substance—namely, *insensible perspiration,* which is so called because we do not so palbably perceive it as we do the former. You will probably be surprised to learn, that of every eight pounds of substance lost by the body, five are lost by this means; and that in the course of twenty-four hours every person, on an average, loses from three to six pounds from this cause. The manner in which this was proved, I shall take the liberty of reading to you from a paper of mine, published in one of the periodicals some time since on this subject. Insensible perspiration, though not directly visible to the sight, may easily be rendered apparent by placing our hands upon a cool metal surface, or upon a looking-glass; we shall then perceive a slight moisture which has proceeded from them. This is the insensible perspiration; and when it is recollected that it is constantly being given

off from the whole surface of the body, day and night, summer and winter, it will not appear surprising that we lose so much from this cause. Another source of waste is the vapour from the lungs. This, though trifling in quantity each time the breath is expired, or driven out from the chest, amounts to a considerable quantity in the course of twenty-four hours. Messrs. Lavosier and Seguin made a series of very accurate experiments to determine the exact waste of the body from these two causes. They proceeded as follows :—They were first enclosed in a varnished silk bag, with no opening, except a small place to breathe through, and which orifice was glued round the mouth of the experimenter, so that the perspiration of the body was of course prevented from escaping into the atmosphere. Before entering into the bag, the experimenter was accurately weighed, and so was the bag also, in order that the weight of each might be known. After he had remained in the bag for an hour or two, he was taken out and again weighed. It was then found that his body had *lost* a certain quantity, and that the weight of the bag was *increased* by very nearly an equal quantity. It was not quite as much heavier as the body was lighter, because a certain quantity had been lost by the vapour of the lungs, which could not of course be confined, but was dissipated in the atmosphere. By this means, the experimenters were able to ascertain how much, in weight, their bodies lost by visible and invisible perspiration in any given period, and they state it to be what I before mentioned; namely, from three to six pounds in twenty-four hours. At different periods of the year, and even of the day, there is a slight difference, but this may be considered a fair average.

(To be continued.)

MOUNTAINS.

The mountains of America are much superior in height to those in the other divisions of the globe. Even the plain of Quito, which may be considered as the base of the Andes, is elevated farther above the sea than the top of the Pyrenees. This stupendous ridge of the Andes, no less remarkable for extent than elevation, rises, in different places, more than one-third above the Peak of Teneriffe, the highest land in the ancient hemisphere. The Andes may literally be said to hide their heads in the clouds; the storms often roll, and the thunder burst below their summits, which, though exposed to the rays of the sun in the centre of the Torrid Zone, are covered with everlasting snow. The height of the most elevated point in the Pyrenees is, according to M. Cassini, 6,646 feet. The height of the mountain in the Canton of Berne is 10,110 feet. The height of the Peak of Teneriffe, according to the measurement of P. Feuille, is 13,178 feet. The height of the Chimborazo, the most elevated point of the Andes, is 20,280 feet, no less than 7,102 feet above the highest mountain in the ancient continent. The line of congelation on Chimborazo, or that part of the mountain which is perpetually covered with snow, is no less than 2,400 feet from its summit.

W. C. D.

[Our correspondent will find that there are higher mountains in Asia than any he has mentioned. A paper on this subject will shortly appear in "The Mechanic." —Ed.]

MULTIPLICATION.

To the Editor of the Mechanic and Chemist.

Sir,—According to Cocker, and not only according to Cocker, but according to Wyngate, Fenning, Dilworth, Fisher, Vyse, Walkingame, and a host of others, it would appear that feet, inches, and parts, may be multiplied into feet, inches, and parts; or what do they mean by saying multiply 12 feet 8 inches and 9 parts, by 9 feet 6 inches and seven parts, and giving rules for doing the same. And if feet, inches, and parts, can be multiplied by or into feet, inches, and parts, what reason can be given why pounds, shillings, and pence, should not or cannot be multiplied into pounds, shillings, and pence, seeing that the questions are similar; for the inches and parts are but fractions of a foot, as also are shillings and pence fractions of a pound. What difference can it make whether we consider the quantities given to be multiplied be feet and parts of feet, pounds and parts of pounds, or whether we consider the quantities as number only, without reference to things, the operations in either case being the same. It appears to me, that the object of the querists was to be informed how pounds, shillings, and pence, could be multiplied into pounds, shillings, and pence, after the same manner that feet, inches, and parts, are duodecimally multiplied into feet, inches, and parts. If such be their object the following is the answer.

Place the given quantities one under the other, pounds under pounds, shillings under shillings, &c., and proceed thus :—

multiply the upper line by the number in the place of pounds in the bottom line, and set down the product as in multiplication of money, pounds under pounds, &c., as in example; multiply the 10s. 6d. in the lower line by the number in the place of pounds in the upper line, thus 9 × 10d. 6d., and place that product as before, pounds under pounds, &c. Multiply the 10 by the 19 in the place of shillings thus—10s. × 19s. = 190s. and say 190s. = 9*l.* 10s; set down the 9 under the place of shillings, and the 10s left, being the half of 1*l.*, is to be considered as the half of a shilling, namely 6d., which is to be set down under the place of pence. Multiply both the figures in the place of pence into the shillings cross-wise, and add the two sums together thus 6s. × 10s. + 6s. × 19s. = 174s., say 174s. = 8*l.* 14s., place the 8 under the place of pence, and the 14 one place farther removed to the right. Multiply the pence into the pence thus—6 × 6 = 36, and say 36d. = 3s., put the 3s. under the 14s., and lastly add the products together into one sum thus—say 14 + 3 = 17, which place on the right of the pence, and put the figure under, making it $\frac{17}{20}$, and go through the other columns as in addition of money, which sum is the product of 9*l.* 19s. 6d. × 2*l.* 10s. 6d.

EXAMPLE.

£.	*s.*	*d.*	
9	19	6	
2	10	6	
9	19	0	
4	14	6	
0	9	6	
0	0	8	14
0	0	0	3
25	3	8	$\frac{17}{20}$

Note.—The $\frac{17}{2}$ are the $\frac{17}{20}$ of a penny.

O. P.

[There needs no Cocker "come from the grave," nor Wingate from Gray's Inn, to teach us accurate enunciation, or to regulate our opinions upon subjects of this nature; we nevertheless, in fairness to our correspondent, insert his letter, but at the same time we pronounce and prove his doctrine erroneous.

The multiplication of feet and inches by feet and inches, is only the working out of a corollary deduced from a geometrical proposition, viz.:—the numbers representing two adjacent sides of a parallelogram being multiplied together, will give the superficial content; but in the case of monies or any other things of different denominations and values, no geometrical demonstration can be obtained, nor does the proposition by fair interpretation contain any intelligible meaning. The following simple analysis will, or ought to, suffice.

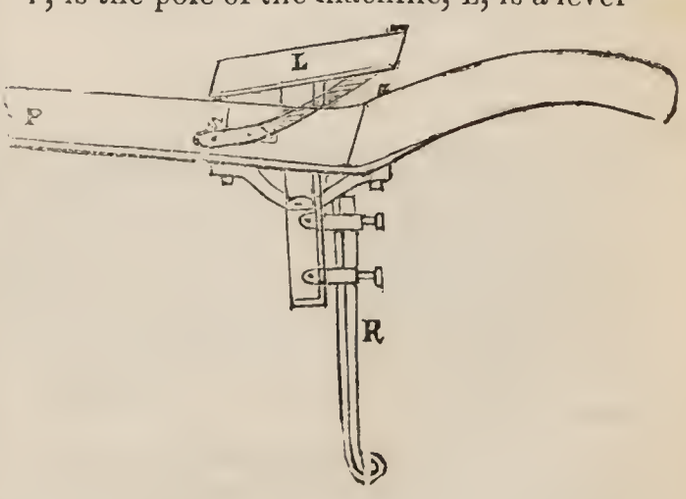
The square of a guinea is a guinea; that is to say, $1^2 = 1$ to whatever value or thing the unit may refer; but the square of 21 shillings is 22*l.* 1s., and the square of 1.05*l.* is 1.1025*l.* A pound and a shilling multiplied by a pound and a shilling, either means nothing at all, or it may be made to mean anything you please. Let x be a pound and y a shilling, then $\overline{x+y}^2 = x^2 + y^2 + 2xy$, in which expression the whole absurdity is concentrated in the $2xy$, for x^2 must be 1*l.*, and y^2 1s.; but $x \times y$ must be greater than $y \times y$, and less than $x \times x$; it cannot therefore be either a pound or a shilling: now the involution of two unities can produce nothing but a unit of some kind, therefore no intermediate quantity between a pound and a shilling can be the result, consequently xy has has no assignable value. Say $x = 1l.$ and $y = \frac{1}{20}$, we shall have $x^2 = 1l$, $y^2 = \frac{1}{400}$ and $2xy = \frac{1}{10} = 1\frac{41}{400} = 1.025$.—Ed.]

JONES'S IMPROVED VELOCIPEDE.

To the Editor of the Mechanic and Chemist.

Sir,—In compliance with the wish of your correspondent "T. Ireland," I have sent you this plan of an improvement on the velocipede, and shall thank you for its insertion.

r, is the pole of the machine, L, is a lever



or foot-board on which the feet are pressed at every pull at the crank lever, which will impel the machine forward and over-

come the dead centres; s, is a spring to push the lever back, r, is a rod of iron which can be regulated to come to the ground by the two screws.

I remain yours truly,

J. JONES.

No. 1, Ratcliff Grove, St. Lukes.

MISCELLANEA.

Starch.—This substance, the Latin name for which is *amylum*, is the fecula of flour or potatoes. The general purposes for which starch is used, are too well known to need description, but it may not be so well known, that when roasted at a moderate heat, it is converted into a species of gum, which is much used by calico-printers. Starch chiefly exists in the friable parts of the vegetable substances, it abounds in the roots of tuberose plants, and also in the seeds of those of agramiverous nature. It contains carbon, oxygen, hydrogen, and, according to M. Saussure, Azote in a small proportion. Under the process of distillation, starch gives out acetous acid, a trifling quantity of oil, and much of both carbonic acid and carburetted hydrogen gas. Starch obtained from potatoes differs in more ways than one from that made of flour, it is more brittle, requires less heat to turn it into jelly with water, and is also soluble in leys containing more diluted alkali.

WILLIAM V——E.

Fecula.—This is a substance obtained from different vegetables by grinding and afterwards steeping them in water; the part which after a time is precipitated or cast to the bottom is the fecula. This substance is distinguished from gum or mucus, by its insolubility in cold water.

WILLIAM V——E.

Silkworms.—It appears from the statement of a late writer, that it requires thirty thousand worms to produce five pounds of silk. If we reckon that at the present time a million and a half pounds are imported annually, it therefore seems that nine thousand millions of insects are kept constantly working in order to furnish the British with the raw silk, from which we make such a beautiful article of manufacture.

QUERIES.

How to make white varnish, or where it can be purchased? P. T.

What are the principles for setting out a pattern for an oblong copper vessel 7 inches by 9 on the top, 5 inches by 4½ on the bottom, and 3 inches deep? Also, on what principle I must set out a pattern for an oval vessel 12 inches by 8 on the top, 6 inches by 3½ on the bottom, and 5 inches deep? T. P.

[One of the objects of this work is to afford a medium of communication between practical men throughout this kingdom; and also between practical men and theorists; we therefore frequently leave questions of this nature in the hands of our numerous and intelligent correspondents. We of course could give an accurate geometrical solution of the above; but we must confess, that a "cunning artificer" would explain himself more familiarly to a brother workman, than probably we might be able to do. We will, however, if necessary, supply the answer, as clearly as geometrical accuracy will allow.—ED.]

1. The best method of denoting the density of the blast blown into a blast furnace? 2. Having some large water-tight cisterns to make of cast-iron plates screwed together, I should like to be informed of the best mode of making a cement for the joints? I believe there is nothing better than iron borings mixed with a solution of sal ammoniac, but I am unacquainted with the proper proportions of each. Perhaps some of your readers may suggest the introduction of some other ingredients by way of improvement. 3. The best work on metallurgy, and, if possible, the price? SHERWOOD.

ANSWER TO QUERY.

I would with all deference beg to suggest to "W. W.", who answered the copper-ball question (vide No. 60, New Series), that the solidity in inches of a body of copper multiplied by the decimals .32, gives the weight in lbs. avoirdupoise, which I think he will admit to be a much shorter and simpler method than the one he has adopted. The multiplier for cast-iron is .26.

SHERWOOD.

TO CORRESPONDENTS.

T. R. Bilbrough—*We thank him for his receipts, but fear they are not sufficiently accurate for publication.*

W. Evans.—*We shall be glad to see his plan for preventing accidents in descending the shafts of mines—it shall have our best attention.*

A. Subscriber.—*We know of no better material for the springs or tongues of the seraphine than good rolled brass. Brass wire is not near so good, nor so convenient. We beg leave to suggest to correspondents who sign "a subscriber," the convenience of adopting some distinguishing name or letter, in order to prevent mistakes.*

A Correspondent Clements Inn *is not sufficiently explicit to make his meaning understood.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 71, NEW SERIES. } SATURDAY, JAN. 18, 1840. PRICE ONE PENNY. { No. 192, OLD SERIES

SELF-ADJUSTING LETTER-BALANCES.

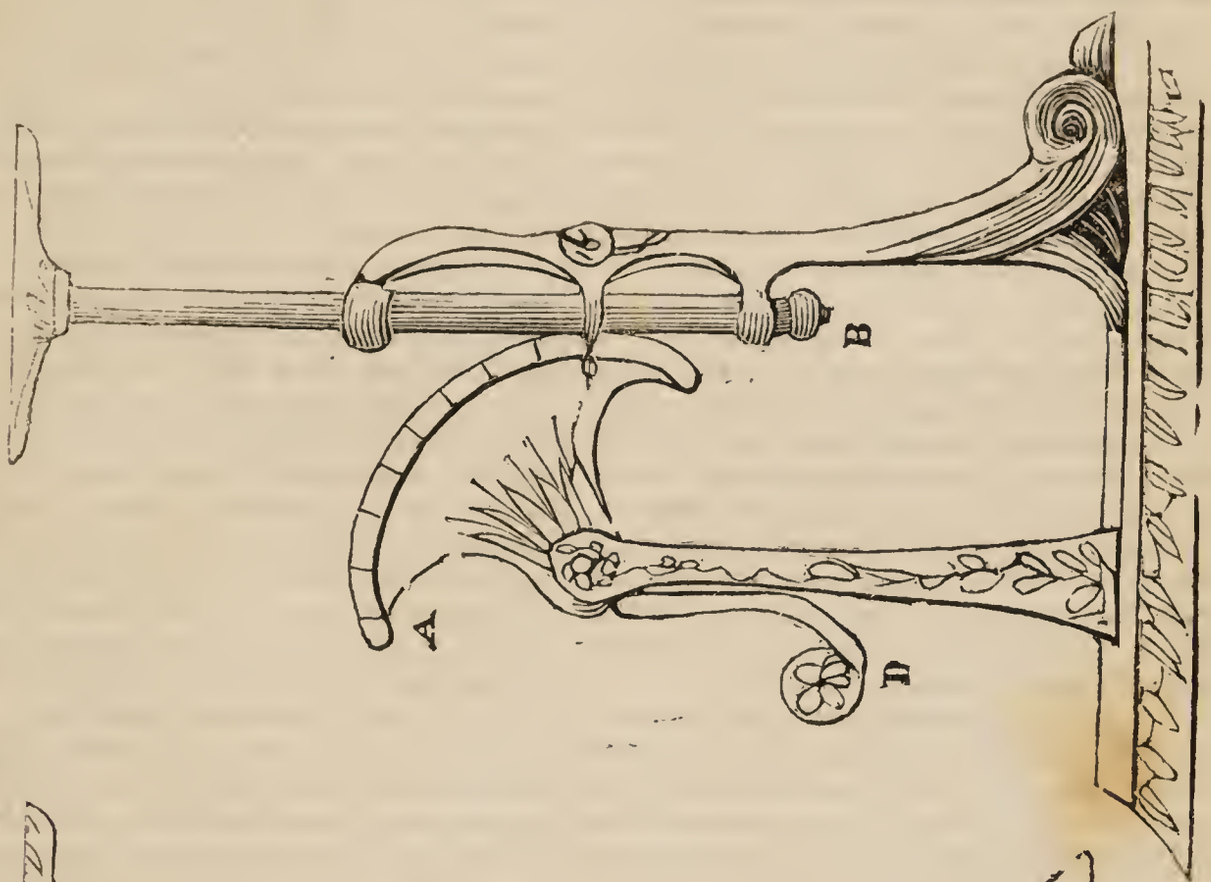

Fig. 1.

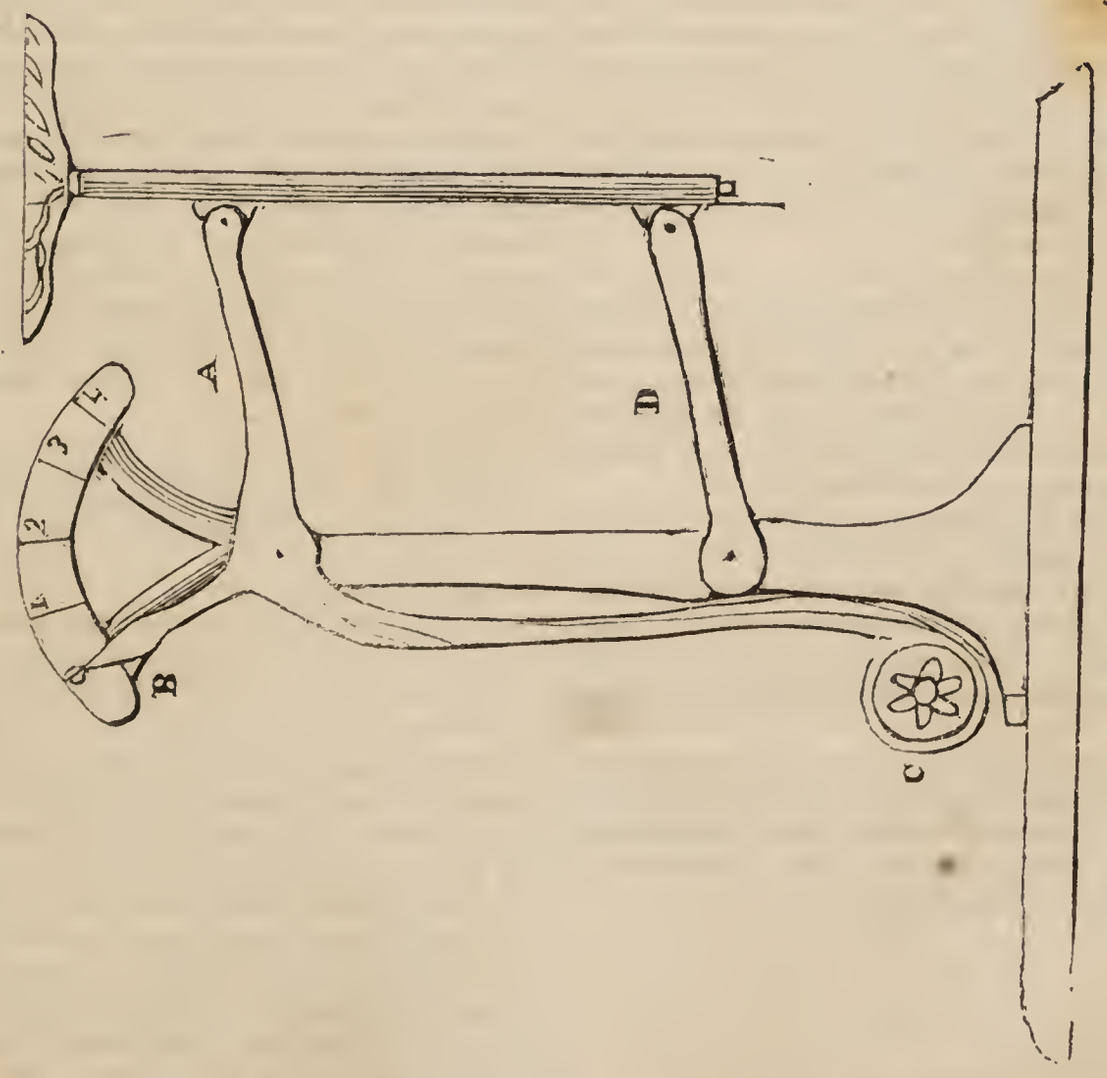

Fig. 2.

VOL. V.—No. 22.]

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

SELF-ADJUSTING LETTER-BALANCES.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—In offering the above sketch (fig. 1) of a letter-balance, I beg to observe, that the only advantage it is presumed to possess over the very neat and scientific plan of Mr. Riddle's, consists in a greater facility of placing and withdrawing a letter, which in many mercantile and other offices, having frequent occasion for its use, will be of some importance, as saving time, &c. I also send the enclosed plan of another kind, invented by me above a week ago; but as it appears that the same principle of a subspiral spring has since been brought out by Mr. Lund, (registered 17th instant) a few days after my own invention had been consummated (for I succeeded in making one which answered tolerably well on the 14th instant), my particular description may perhaps be dispensed with; at all events, Mr. Editor, you can insert the most recent affair, fig. 1, the invention of this present day, as being simple, facile, and correct.

At A, near the upper angle of the quadrant, is a small perforation, through which a silken cord, or other material not likely to give or to stretch, is passed, and after being conducted round the circular portion of the quadrant (in which there must be a groove), is brought in contact with the upright shaft, and after passing through another aperture at the lower end, is secured by a knot.

A letter being placed on the cup will cause the shaft to descend, and the degree or weight will be pointed out by the index at C. D is a weight of about three quarters of an ounce, or such as to admit of two ounces being indicated on the graduated quadrant, if required.

Fig. 2 is another application of the same principle. The upper arm, A, the index, B, and the weight, C, are immovable with regard to each other. The lower arm, D, is merely passive, and serves only to preserve the perpendicularity of the shaft.

The sole object of these plans is to avoid the swinging holders, which cause too much vibration, and are also inconvenient where frequent use and quickness of weighing are required.

J. B.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 156.)

THE loss by insensible perspiration is much greater than by what is commonly termed perspiration, which is, in fact, only an accumulation of the former. If you look closely at your hand when it is warm, you will perceive, even with the naked eye, on the little ridges which run across it, rows of very minute orifices. It is through these that the perspiration is given out, and they are as numerous over the whole surface of the body as they are on the hand. The perspiration which oozes from them when the hand is warm may be seen to glitter brilliantly in the sun, and the little spots, not half so large as the point of a very fine needle, shew how exceedingly small must be the tubes from which they proceed. Another example of insensible perspiration may be found in the peculiar odour which distinguishes different individuals and animals, as it is supposed to depend principally on this cause. Most animals have a distinct odour peculiar to themselves, and by which, indeed, they are tracked when hunted; and creatures that have a fine sense of smell can readily detect different persons by this means alone. A dog will often trace his master for miles entirely by scent, although most persons might be able to discover no odour. It is in consequence, also, of the insensible perspiration being so much greater in some persons than others, that they are thinner, and that some require a greater quantity of food. Anxiety and thought have a great influence in the matter. You will remember how Shakspeare notices this fact. In the play of Julius Cæsar, he makes Cæsar say—

"Let me have men about me that are fat,
Sleek-headed men, and such as sleep o' nights.
I like not yonder Cassius; he hath a lean and
hungry look;
He thinks too much.
Would he were fatter! but I fear him not:
Yet if my mind were liable to fear,
I do not know the man I should avoid
So soon as that spare Cassius."

The remarks well illustrate the physiological fact I have just mentioned, that persons of thoughtful mind lose much more by insensible perspiration than those "sleek-headed men, who sleep o' nights."

I may, perhaps, mention, before quitting this topic, that a "common cold" is the consequence of any sudden stoppage of the function I have been describing; and you will understand, therefore, why warm,

dilutent drinks are given to persons suffering from this cause; they excite the blood-vessels of the skin to action, and by renewing the insensible perspiration, relieve the cold.

Now as this waste of the body, on which I have been dilating, is continually going on, and as persons in health do not vary much in size and weight,—unless, indeed, in the case of young persons, to grow larger,—it is evident there must be some continual source from which the loss can be supplied. This is the blood; and its circulation is the means by which the food we eat, after it has been converted into "the living tide," is made to contribute to our nourishment and support.

A second grand use of the circulation is, to supply the different organs with vitality—with life. We find, for instance, that the brain is largely supplied with vessels that convey the blood to it almost direct from the heart; and if these vessels are tied, or the supply of blood in any way stopped, death is the almost instantaneous result. Nor is it alone necessary that blood only should be so supplied—it must be *arterial* blood, purified by contact with the air in the lungs, from the impurities it received in its passage through the body. Unless a continual and fresh supply of this fluid is kept up, the animal immediately perishes. For instance, when criminals in this country are executed, death is most frequently produced by suffocation—by the want of a supply of fresh air to purify the vital fluid, before it is sent from the heart upwards to the brain. And when persons die from inhaling impure gases, or from drowning, the cause in each case is the same. When the circulation also is interfered with by the vessels being pressed upon, so that the passage of the blood is impeded in its progress through the veins from the brain, apoplexy is not unfrequently produced; and many gentlemen who tie their cravats a great deal tighter than is necessary, are not, perhaps, aware, that they are putting their lives in danger by so doing. Besides the brain, every other part of the body requires a constant fresh supply of the living stream, in order to preserve it in a state of health, though death does not so immediately ensue from any irregularity in such cases as in the case of the brain. If, however, the supply be cut off, from the arm, for instance, mortification in a very short time ensues; in other words the part dies, and it is only by causing a good healthy current to be continually distributed to every part, that the body, as a whole, can be maintained in a state of health, and the individual be rendered capable of enjoying the good things of this life, which has been allotted as his portion. This is one lesson, therefore, which, I trust, will be borne in mind; and I hope that, having thus shown you the importance of the circulation in a few instances, I shall have rendered you desirous of knowing how it may be maintained in a healthy state, and that you will also be better capable of understanding and deriving entertainment from the description I am about to give of the organs by which the circulation is carried on both in man and the lower classes of animals, and of the vital means by which the circulation is effected.

As I have just stated, it is necessary in the human body that the blood, before it is sent out from the heart to the different organs, should be purified by being brought into contact with the atmosphere in the lungs, during the act of respiration. In man, therefore, there are, properly speaking, two distinct circulations,—one from the heart through the lungs, and back again by another set of vessels; and the other from the heart over the whole body, and back again to the same organ. In all the higher class of animals which respire the same as we do, there is the same double circulation; but in the lower orders of animals it is variously modified. Some creatures require only a small portion of their blood to be purified, and in others we can perceive no distinct organs whatever for effecting this object. I will endeavour to give you some idea of the comparative anatomy of the circulating organs, by reference to a few well-known living creatures.

The first appearance of organs for the circulation, is simply a tube passing from one end of the body to the other in the class of animals where this structure is perceived. This tube is called the *dorsal vessel*, because it is found along the back of the animal, and it appears to possess the power of contracting and dilating, so that its contents may be pressed forward. It is a curious fact, however, that the dorsal vessel appears to have no connexion at either end with vessels through which the fluid it contains could be passed; and it was formerly supposed that the blood of the creature was merely kept moving backwards and forwards in this tube, without any progressive movement. Dr. Roget, however, states, that it has been discovered the fluid does pass out at one end of the vessel, and passing through the substance of the animal's body, enters the tube at the other end. The dorsal vessel may be observed in the caterpillar, the

spider, and the earthworm, and if the creature be attentively examined for some time, you will observe a series of contractions and dilitations along its back, which are, in fact, the action of the dorsal vessel.

(*To be continued.*)

ON LIFE ASSURANCE.

(*Continued from page* 153.)

In all financial combinations where a chance of great gain is promised, there must necessarily be a corresponding risk of loss; since it is with the money of those who pay more than they receive, that others are enabled to receive more than they pay. But so extraordinary are the circumstances of assurance, that it is always desirable to lose, and nothing short of a great calamity will entitle the insured to gain. Who, indeed, ever complained of his house and property being preserved from fire, because that circumstance enriched the insurance office? Or who, for a similar reason, would desire a premature death?

If the principles of insurance were more generally known and adopted, it would, no doubt, be considered one of the first duties of the father of a dependant family, to provide, by assurance, against one, at least, of the grievous consequences of the ever-impending bereavement of death. "The theory of insurance," says M. De Morgan, "is, in fact, in a limited sense, and a practicable method, the agreement of a community to consider the goods of its individual members as common. It is an agreement, that those whose fortune it shall be to have more than average success, shall resign the overplus in favour of those who have less. And though, as yet, it has only been applied to the reparation of the evils arising from storm, fire, premature death, disease, and old age, yet there is no placing a limit to the extensions which its application might receive, if the public were fully aware of its principles, and of the safety with which they may be put in practice."

Unfortunately, however, the practical execution of these theories is attended with much difficulty and danger. It appears that many of the recently-established companies have already "broken up;' and such is the extent to which the system of puffing is carried, even by really respectable companies, that it is difficult to discover which of them is most secure from a similar fate. The Secretary of the Provident Life Office has the following in an advertisement in 1839:—"In 1806 there were only *eight* life offices in London, including the Provident. Since then their number has increased to nearly *one hundred*; of these, about *thirty* have broken up, and *seventy-two* is their number in the London Directory for the present year."

We cannot undertake the delicate and invidious task of recommending certain offices as more secure than others; we can only speak of general principles, and leave their application to our readers; but we wish particularly to caution them against puffing prospectuses and advertisements. Professor De Morgan, speaking of the present system of puffing, says, "Of one thing I am certain, that the magnificent style in which the prospectuses frequently indulge, might often remind their readers of the unparalleled benefits which are promised by another description of traders, who vie with each other in describing the rare qualities of their several *blackings*. If there be in this country a person whose ambition it is *to walk in the brightest boots to the cheapest insurance office*, he has my pity; for, grant that he is ever able to settle where to send his servant,—and it remains as difficult a question to what quarter he shall turn his own steps,—the matter would be of no great consequence, if persons desiring to insure could be told at once to throw aside every prospectus which contains a puff: unfortunately this cannot be done, as there are offices which may be in many circumstances the most eligible, and which adopt this method of advertising their claims. If these pompous announcements be intended to profess that every subscriber shall receive more than he pays, their falsehood is as obvious as their meaning; if not, their meaning is altogether concealed."

(*To be continued.*)

CEMETERIES OF THE METROPOLIS.

In our last number we gave a plan and description of Sir Christopher Wren's grand project for rebuilding the City of London after the conflagration of 1666; and it was shown that several of our recent improvements had been conceived and recommended by that truly great man. One of the objects he proposed, was the removal of all grave-yards and other receptacles of the dead, to a proper distance from the city; he was, however, frustrated in his enlightened endeavours by the superior power of prejudice—that formidable barrier to all amelioration, powerful in all nations and in all ages, but impreg-

nable to reason, when surrounded by the stagnant moat of ignorance; but if prejudice is stronger than reason, there is a power superior to them both—that power is interest. Before, however, we proceed to combat the resistance of prejudice, we must, by unanswerable argument, prove that our cause is really that of reason: this task is easier than agreeable; but we deem it essential to the health of the metropolis that so intolerable a nuisance should be removed, and we shall point out our reasons for recommending our readers to exercise their utmost influence to promote so desirable an object. We have more to say upon this subject than our limited space will at present allow; and shall therefore defer till another occasion the more complete development of our sentiments. The following extracts from Mr. Walker's "Gatherings from Graveyards," will be sufficient to attract the attention of citizens to this very serious subject:—

"*Clement's-lane.*—It is surrounded by places, from which are continually given off emanations from animal putrescence. The back windows of the houses on the east side of the lane look into a burying ground called the 'Green ground,' in Portugal-street, presently to be described: on the west side the windows (if open) permit the odour of another burying place—a private one, called Enon Chapel—to perflate the houses; at the bottom—the south end—of this Lane, is another burying place, belonging to the Alms' Houses, within a few feet of the Strand, and in the centre of the Strand are the burying ground and vaults of St. Clement Danes; in addition to which, there are several slaughter-houses in the immediate neighbourhood; so that in a distance of about two hundred yards, in a direct line there are four burying grounds; and the living here breathe on all sides an atmosphere impregnated with the odour of the dead.

"*Burying Ground, Portugal-street.*—The soil of this ground is saturated, absolutely saturated, with human putrescence. * * The effluvia arising from this ground, at certain periods, are so offensive, that persons living at the back of Clement's-lane, are compelled to keep their windows closed; the walls even of the ground which adjoins the yards of those houses, are frequently seen reeking with fluid, which diffuses a most offensive smell.

"*Enon Chapel.*—This building is situated about midway on the western side of Clement's-lane; it is surrounded on all sides by houses, crowded by inhabitants, principally of the poorer class. The upper part of this building was opened for the purposes of public worship about 1823; it is separated from the lower part by a boarded floor: this is used as a burying place, and is crowded at one end, even to the top of the ceiling, with dead. It is entered from the inside of the chapel by a trap door; the rafters supporting the floor are not even covered with the usual defence—lath and plaster. Vast numbers of bodies have been placed here in pits, dug for the purpose, the uppermost of which were covered only by a few inches of earth; a sewer runs angularly across this 'burying place.' * * Soon after interments were made, a peculiarly long narrow black fly was observed to crawl out of many of these coffins; this insect was observed on the following season to be succeeded by another, which had the appearance of a common bug with wings. The children attending the Sunday School, held in *this chapel*, in which these insects were to be seen crawling and flying in vast numbers, during the summer months, called them 'body bugs,'—the stench was frequently intolerable.

"*St. Clement's Church, Strand.*—There is a vault under this church called the '*Rector's Vault*,' the descent into which is in the aisle of the church near the communion table, and when opened, the products of the decomposition of animal matter are so powerful, that lighted candles passed through the opening into the vault, are instantly extinguished; the men at different times employed, have not dared to descend into the vault until two or three days had elapsed after it had been opened, during which period the windows of the church also were opened to admit the perflation of air from the street to occupy the place of the gas emitted; thus a diluted poison is given in exchange from the dead to the living in one of the most frequented thoroughfares of the metropolis. * *

"*Drury-lane Burying Ground* belongs to the parish of St. Martin's-in-the-Fields; many thousands of bodies have been here deposited. The substratum was, some years since, so saturated with dead, that the place 'was shut up' for a period. The ground was subsequently raised to its present height—*level with the first floor windows surrounding the place*, and in this superstratum vast numbers of bodies have, up to this period, been deposited.

"*Buckingham Chapel*, situated in Palace-street, about three minutes' walk from Buckingham Palace.—There are two vaults and a burying ground belonging to this chapel; one of the vaults is *underneath very large school rooms for boys and*

girls, and the other is *underneath the chapel*; the entrance to these vaults is through a trap door, in the passage, dividing the school-rooms from the chapel; steps lead to the bottom of the building; on the right is the vault underneath the schools. * * The vault is supported on wooden pillars, and there is only one grating, which fronts the street, to admit light and air; the floors of the school-rooms, white-washed on the under surface, form the roof of the ceiling to the vault—it is no difficult matter to see the children in the lower school-room from this vault, as there are apertures in the boards sufficiently large to admit the light from above. This place is spacious, but very low;—the vault on the left, under the chapel, is about the same size as that under the schools, though much lower. I was assured that the ground was so full of bodies, that there was difficulty in allotting a grave; the roof of this vault is formed by the under surface of the floor of the chapel; it is whitewashed, the light passes through it; the smell emitted from this place is very offensive. In the vault underneath the chapel there are piles of bodies placed in lead; the upper ones are within a few inches of the wooden floor. On a level with the chapel, and behind it and the school rooms, is the burial ground, which is much crowded,—most of the graves being full seven feet deep, and nearly filled to the surface with the dead; the ground is raised more than six feet from the original level,—formed only by the debris of mortality. No funerals are permitted on a Sunday."

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 92.)

The mansion is situated on a fine sloping lawn, with the principal front facing the south; this measures 916 feet from east to west, and consists of a centre, connected by elegant colonnades, to two pavilion wings, of the same height as the centre, a projecting pediment supported by six beautiful Corinthian columns, and two pilasters, forms the grand entrance; from hence, the descent to the lawn is by a flight of 31 steps, at the bottom of which, there is on each side a massive stone lion finely executed. The interior displays all that the power of art, added to an exquisite refinement of taste, could possibly produce; expense does not appear to have ever entered the mind while forming and decorating this superb mansion. Its various apartments are of noble dimensions, and contain a vast collection of paintings of great merit and value, besides several curious specimens of the antique, all of which are judiciously disposed in appropriate situations. The library is suitably furnished; it contains about 10,000 volumes, besides a number of unpublished writings, including many Irish manuscripts, and the whole of the works of the celebrated Charles O'Connor; but notwithstanding the various claims to notice which almost all the apartments possess, the saloon appears to deserve most attention, on account of its antique grandeur; this is paved with the finest Carara marble, in squares of four feet each; it contains a number of elegant scagliola columns, in imitation of Sicilian jasper, with white marble bases and capitals; twelve niches are occupied by large statues and candelabra of exquisite workmanship, besides which here is a frieze and cornice in alto relievo, by that eminent artist Signor Valdre. This apartment, with all its combined decorations, is transcendently magnificent; but when lighted, and filled with the melodious strains that issue from a concealed music-gallery, the effect is considerably heightened.*

Brackley, a market town in Northamptonshire, is situated upon a descent near a branch of the Ouse, seven miles and a half from Buckingham, and sixty-four from London. It is a place of very great antiquity, and was a flourishing town in the time of the Saxons. It attained considerable commercial importance after the Conquest, but has since decayed into comparative insignificance, and was disfranchised by the Reform Bill. Some vestiges of its former greatness may still be traced; and these, illuminated by the expiring taper of tradition, are the only testimonies of its departed grandeur. So imperfectly, indeed, is its history known, that historians cannot agree in deciding whether it first sent members to Parliament in the reign of Edward I., or in the reign of Henry VIII. It contains two churches, a hospital, a free school, and a market hall, with a good market on Wednesday.

To the Editor of the Mechanic and Chemist.

Sir,—Having observed in your last number of the "Mechanic and Chemist," a notice of a society formed at Sheffield for

* For a portion of the preceding description of Stowe, we are indebted to Britten and Brayley's "Beauties of England and Wales," and to several other publications.

the study of mechanics and chemistry, and being desirous of assisting in the formation of such a society, I have ventured to request the favour of your inserting this letter to the readers of your valuable magazine in this neighbourhood (Charing-Cross), for the purpose of forming a society on the same principle as that at Sheffield. The reason why I propose such a spot is, because I am so situated that the narrow limits of an apprentice's leisure-hours will not admit of my attending one situated any great distance from my situation; and I have no doubt that there are many of your readers in the neighbourhood who are placed in a similar situation and of the same opinion, and who, I have no doubt, will very readily assist in the formation of a society of the kind. Hoping, therefore, that in a short time such societies may be spread all over England, I beg to subscribe myself,

Your obedient servant,

J. C.

21, Great Newport-street.

MISCELLANEA.

To make Coloured Fires.—Blue. 1 sulphuret of antimony, 2 sulphur, 4 nitre.

Crimson.—1 sulphuret of antimony, 1 sulphur, 1 chlorate of potash, 5 nitrate of strontian.

White.—1 coal, 1 sulphur, 4 nitre.

Yellow.—1 coal, 1 sulphur, 1 lamp black, 1 rosin, 4 nitre.

Green.—1 sulphur, 1 sulphuret of antimony, 2 chlorate of potash, 4 nitre, 5 nitrate of barytes. Or, 1 sulphur, 1 sulphuret of antimony, 5 nitre, 5 nitrate of barytes. Or, 1 chlorate of potash, 1 sulphur, 1 sulphuret of antimony, 10 nitrate of barytes. Or, 1 lamp black, 4 sulphuret of antimony, 5 chlorate of potash, 13 sulphur, 80 nitrate of barytes. T. Kentish.

Mode of getting rid of Snails.—These creatures are passionately fond of bran, or the outward skin of wheat. When this food is placed out for them, they leave it as seldom as possible, and when they do retire for a time, they return most eagerly to again feed on it. This suggests a mode of freeing any piece of ground of insect. You have only to place over little heaps of bran, pieces of broken pipes, or pots, or vessels of any kind, which may shelter the food from the rain, and your work is done. The snails will congregate below, and you can in a short time destroy vast multitudes of them.

Growth of Fish.—The rapid growth of fish is very extraordinary. There were three pike taken out of a pond, two of which weighed 36lbs. each, and the other 35lbs. The pond was fished every seven years, and supposing that store pike of six or seven pounds' weight were left in it, the growth of the pike must have been at the rate of four pounds a year. Salmon, however, grow much faster, for it has been ascertained that grisle, or young salmon, of two and a half to three pounds' weight, have been sent to the London markets in the month of May, the spawn from which they came having only been deposited in the preceding October or November, and the ova taking three months to quicken. It has also been ascertained by experiment, that a grisle which weighed six pounds in February, after spawning, has, on its return from the sea in September, weighed thirteen pounds; and a salmon fry of April will in June weigh four pounds, and in August six pounds.—*Gleanings of Nat. Hist.*

The Larch.—This species of fir, or pine, which is now seen in every gentleman's plantation, was accidentally brought to Scotland about a hundred years ago. A Mr. Menzies, while in London in 1737, hearing of a beautiful pine shrub recently imported, procured four plants, two of which he gave to the Duke of Atholl, and may be called the parents of all the larch in the kingdom; a third to a gentleman of Monzie, and kept the fourth for himself. The larch has proved a valuable acquisition to the produce of many barren moors in the Highlands of Scotland, where the climate is found more favourable for this species of pine than in the plains.

Cork.—Many persons see corks daily used, without knowing whence come these exceedingly useful materials. Corks are cut from large slabs of bark of the cork tree, a species of the oak which grows wild in the countries in the south of Europe. The tree is generally divested of its bark at about fifteen years' old; but before stripping it off, the tree is not cut down, as in the case of the oak. It is taken while the tree is growing; and the operation may be repeated every eighth or ninth year, the quality of the cork continuing each time to improve as the age of the tree increases. When the bark is taken off, it is singed in the flame of a strong fire; and after being soaked for a considerable time in water, it is placed under heavy weights, in order to render it straight. Its extreme lightness, the ease with which it may be compressed, and its elasticity, are properties so peculiar to this substance, that no efficient substitute for it has yet been discovered. The valuable properties of cork were known to the Greeks and Romans, who employed it for all the purposes for which it is used at present, with the exception of stopples for bottles—the ancients mostly employing cement for closing the mouths of vessels. The Egyptians are said to have made coffins of cork, which, being spread on the inside with a resinous substance, preserved dead bodies from decay. In modern times, cork was not generally used for stopples to bottles till about the close of the 17th century, wax being till then chiefly in use for that purpose. The cork imported into Great Britain is brought principally from Italy, Spain, and Portugal. The quantity annually imported is about 5000 tons.—*Encyclopædia.*

Removal of a Bog.—On Saturday last, this hitherto peaceable town, Kanturk, was thrown into the greatest state of excitement. It appeared that about three hundred acres of Colonel Longfield's bog, at Farrandoyle, had, truant-like, gambolled through the country, a distance of four miles, and was about paying a Christmas visit to the Kanturk folks. The scene was terrific. Onward moved the mighty and over-

whelming mass, carrying destruction in its course. Occasionally it moved in a compact body; sometimes, on meeting obstructions, it rose in angry surges like the ungovernable sea, elevating enormous pieces of bog-wood. The course of the Brogeen stream was soon impeded, as the bog got into the valley, and the water having become considerably swollen and accumulated behind, forced on the whole mass with fearful violence, and dispersed the bog-stuff and timber to a considerable distance up the acchivities. It is to be regretted that bog timber, to the value of at least 500*l*., passed off into the Brackwater, the people being unable to come at it on account of the great depth of the surrounding bog-stuff; and it is calculated that no less than 1200 acres of meadow and pasture land have been covered, at an average of ten feet. The first movement of the bog was observed by Mr. R. Swaine, of Kanturk, who was shooting on it at the time, and who narrowly escaped being lost; Mr. Swayne having got on *terra firma*, ran with all his might to give warning of the danger; but his speed was unequal to the task, and one house was overwhelmed before he could call out; fortunately, however, no lives have been lost. The bog is still moving, and, it is thought, will continue so for many days.—*Cork Standard*.

Smoking in Germany.—The propensity of smoking is declared by the German physicians to be actually one of the most efficient causes of the German tendency to diseases of the lungs. In point of expense, its waste is enormous. 50,000 boxes of cigars have been consumed in a year, each box costing about 3*l*.—150,000*l*. puffed into the air! This plague, like the Egyptian plague of frogs, is felt everywhere and in everything: every eatable and drinkable, all that can be seen, felt, heard, or understood, is saturated with tobacco; the very air we breathe is but a conveyance for this poison into the lungs. One mighty-fumigation reigns, and human nature is smoke dried by tens of thousands of square miles. It is computed, that of twenty deaths of men between 18 and 35, ten originate in the waste of the constitution by smoking. The universal weakness of the eyes is attributed to the same cause of general nervous debility. Tobacco burns out their blood, their teeth, their eyes, and their brains; turns their flesh into mummy, and their mind into metaphysics.—*Hamburgh Paper*.

QUERIES.

Can any of your correspondents inform me where I can obtain the following articles at a cheap rate? I do not wish to have highly-finished workmanship, only requiring the outside to be smoothed, but of course to be true in the bore:—Two cylinders, pistons, and rods; also slide valves, the same size and shape commonly used in the present models?

A Young Beginner.

1. The best and cheapest mode of constructing an oxyhydrogen microscope?

2. The best method of gilding ivory? I have tried that given in No. 3 (N. S.), but can produce nothing but a brown stone.

Felix Wriss.

Can any of your readers inform me of the best, cheapest, and most simple method of constructing a miniature working model of a steam engine, and where I can get the materials; and also what the spindle is made of belonging to the cheap electrical machine described in No. 37?

Juvenile.

TO CORRESPONDENTS.

A Constant Reader.—*Aromatic fumigating pastils consist chiefly of cascarilla (cortex cascarillæ), which may be mixed with any convenient combustible substance. The bark alone, if well dried, will answer the purpose without any preparation.*

Electron *will hear from "Tyro Chemicus" all we desire to say, and, indeed, all we can say upon the subject of his two last communications. We cannot even conjecture the purport of the letters which he supposes were sent to our office, but which, we repeat, have not been received.*

Sherwood *has not multiplied pounds by shillings, but pounds by fractions of a pound. It is true that a shilling is, in value, one-twentieth part of the value of a pound; but it is also an integral sum in itself, and may as properly be compared with a crown or a guinea, as with a pound. We repeat that the operation is impossible, and trust that our correspondents will pardon us if we decline inserting any more fruitless and utterly hopeless attempts to do that which is impossible to be done.*

C. E. (Coventry) *will receive the best information we can obtain on the subjects of his queries.*

H. W. *shall have our earliest attention.*

Our next number being a double one, we shall be enabled to answer many querists omitted this week, owing to want of space.

Errata.—At page 150, first column, line 45, read, "is equal to the cube of its diameter," &c; and next line $\frac{8^3 \times .5236}{2} = 8^3 \times .2618 =$ &c.; and since a pound of water contains 27.7274 cubic inches, hence $\frac{8^3 \times .2618}{27.7274} =$ the weight of the water at once. 1000 ounces to a foot of water, also, is only an approximation, in round numbers.—Second column, line 5, read "lies between 101 and 102;" and next line

$$\frac{89^3}{101^3} = 53.661;$$ and, four lines lower,

$$\frac{89.39^3}{101.35^3} = 54.08.$$

W. W.

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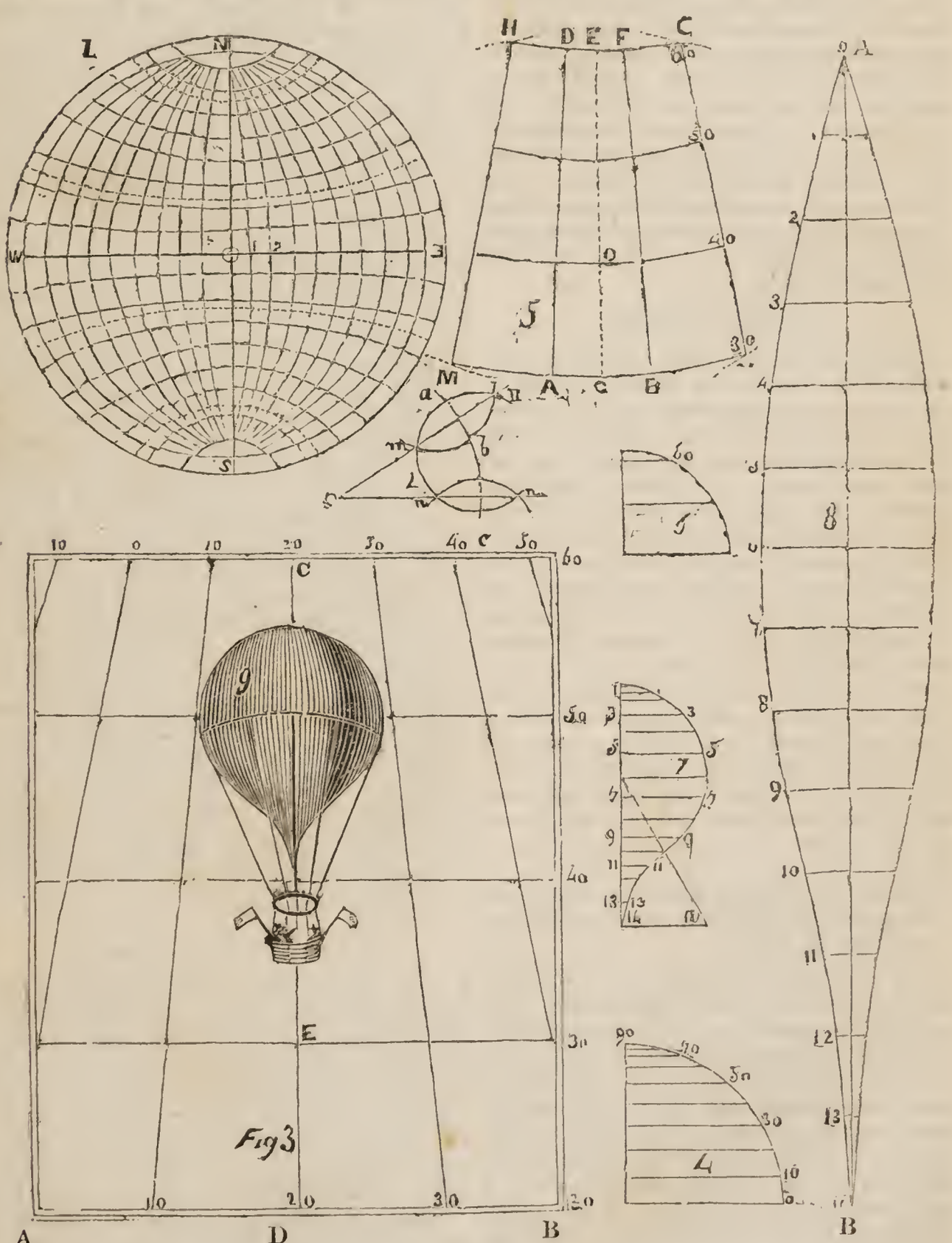
PROJECTION OF MAPS, GLOBES, BALLOONS, PARACHUTES, ETC.



VOL. V.—Nos. 23 & 24.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PROJECTION OF MAPS AND BALLOONS.

(See Engraving, front page.)

A MAP is a projection of the surface of the globe upon a plane. In this, three things are necessary:—the correct representation of the circles, the proportional magnitudes of places, and their relative positions or bearings. Only two of these, however, can be effected at once, on account of the difference between a plane and a convex superficies. The usual projections are the orthographic, the stereographic (Mercator's), and the globular. In the orthographic, the circles towards the outsides are too near; in the stereographic, too distant; in Mercator's, the magnitudes of places are extravagantly distorted, and the poles are omitted, but the bearings are shown correctly. The globular, which we shall first treat of, represents equal spaces on the earth by equal spaces on the map, as nearly as any projection will allow.

Globular Projection.

From the centre, O, fig. 1, with any radius, O N, describe the circle, N E S W, in which draw the diameters, N S, E W, crossing each other at right angles. Divide each of the lines, O N, O E, O S, O W, into nine equal parts. Likewise divide each quadrant into nine equal parts; there will then be given three points, N 1 S, N 2 S, &c., through which to describe the arcs, or meridians and parallels, as shown in the diagram. The method of performing this is represented in fig. 2. Let *a b c* be three points through which a curve is to pass; from *b*, with any radius describe the arc, *n n*, *m m*; from *a*, with the same radius, cross it in *m m*; and from C, with the same radius, cross it in *n n*. Through *m m*, *n n*, draw straight lines, meeting each other in *o*; *o* is the centre of the circle required, and *o a*, *o b*, or *o c*, the radius.

To project a Map of a portion of the Earth, in which the Meridians and Parallels are to be Right Lines.

Draw a base line, A B, fig. 3, in the middle of which erect the perpendicular, C D; along this, set off any convenient distance, D E, the requisite number of times, and draw the parallels. With D E, as a radius, describe the quadrant, fig. 4, which divide into nine equal parts, and through the points of division draw lines parallel to the base. The bottom parallel of fig. 3 being 20, take off the length of the cosine 20, fig. 4, and set it along A B, fig. 3, on each side of D, towards A and B. The top parallel being 60, take the length of the cosine 60, fig. 4, and set it off from C, fig. 3, to the right and left. Draw the meridians to the corresponding divisions at top and bottom, and the map is prepared for receiving the countries. If it be required to curve the meridians, take off the *intermediate* cosines. For dividing the quadrant, a protractor is the most convenient instrument. This any one may readily construct for himself, with a piece of card board.

To project a map in which the meridians are to be right lines, and the parallels curves, draw a base line, A B, fig. 5, in the middle of which erect the perpendicular, C E, and set off upon it any distance, C O, the requisite number of times. With the same distance, C O, describe the quadrant, fig. 6, which divide into nine equal parts, and draw the necessary cosines. A B, fig. 5, being the parallel of 30, take off half the cosine 30, fig. 6, and set it on each side of C, to A and B, fig. 5; do the same with half the cosine 60, for the top, D F. Draw the lines D A, F B. From A and B, as centres, with the transverse radius, A F, describe the arcs, J H G; and from D and F, as centres, with the same radius, sweep the arcs, M N. From A and B, as centres, with the distance, A B, or cosine 30, cross the arcs, M N; and from D and F, as centres, with the distance, D F, or cosine 60, cross the arcs, H G. From the points of intersection draw the lines, B M, G N, and so proceed as often as necessary. The parallels in this case will be parts of immense polygons, which must be rounded off by hand, or by a bow of whalebone or watch-spring. In large maps, where the radiuses are too large for compasses, this method will be found very convenient. We have thus shown three methods; 1st, where the meridians and parallels are both straight lines; 2nd, the parallels straight, and the meridians curved; 3rd, the parallels curved, and the meridians straight. The case in which both are curved, will be treated of hereafter.

To project Globes, Balloons, &c.

The first thing to be determined upon is the number of gores, and the intended circumference. The latter being divided by the former, gives, of course, the middle breadth; the breadths in other parts will be as the cosines, as is evident upon reflection, for the cosines become the successive radiuses of the concentric lesser circles. Then since the gore is to reach half round the globe, its length will be half as many times its breadth as there are gores. Thus, if there be forty gores, the length

will be twenty times the breadth, and so on. This is for a perfect sphere or spheroid, the latter of which is projected from an ellipse, as will be hereafter explained. But a more elegant shape for an air balloon is shown in fig. 9, and in this the length will be one-sixth greater. Montgolfier, or fire-balloons, which require a wider mouth, are the same as globes, with the exception of the bottom quadrant, which is bent outwards for the purpose of receiving the rarefying substance. The most convenient number of gores for balloons not more than ten feet diameter, or ten yards circumference, is twelve. In this case the middle width contains as many inches as the circumference measures feet. Suppose it be required to construct a balloon twelve feet in circumference, the gore will then be twelve inches. With half this for a radius, describe a semicircle, fig. 7; divide the top half into six equal parts, in the points 1, 2, 3, 4, 5, 6; carry four of them round to 7, 8, 9, 10. Draw a straight line from the centre through 10 to *a*, making the distance from 10 to *a* equal to the radius, from which as a centre describe the reverse arc, and carry down four more divisions in the points 11, 12, 13, 14. Draw a straight line, A B, fig. 8, along which set off the radius used in fig. 7, fourteen times, and erect perpendiculars, as shown in the diagram. Measure the distance from 1 to 1, fig. 7, and set it on each side of the straight line to 1 1, fig. 8. Do the same with the distances 2 2, 3 3, &c., and connect the extremities with straight lines. Fig. 8 will be the shape of the gores, of which there are to be twelve. Montgolfiers we shall explain in a subsequent paper. If constructed of tissue-paper, the air-balloons must be previously varnished, as directed at page 70. For the details of pasting, &c., the reader is referred to my "Holiday Companion," mentioned at page 90, in which he will meet with every information requisite to ensure success. By taking the top section of fig. 8, we have the gores for a parachute or umbrella; the bottom section furnishes the more graceful parasol. The table given at page 115 contains the natural cosines, calculated to a radius of 60. The reader will obtain them by multiplying the common tables by 60; also the secants, which he will require hereafter. He must be particular not to confound them with the *logarithmic* cosines and secants. A future paper will explain the method of projecting maps and balloons, without the intervention of tables or diagrams, by means of the sector, which instrument is described in my "Treatise on a Box of Instruments and the Slide Rule," mentioned at pages 34 and 116 of the present work.

T. Kentish.

ON LIFE ASSURANCE.

(*Continued from page* 162.)

A writer in the *Quarterly Review* for last October, commenting on the prospectus of the "Independent and West Middlesex Assurance Company," says,—

"Take just one example, from the terms of this advertisement, to give an idea of the liberality of the 'Independent and West Middlesex.' A person from thirty to forty years of age, say thirty-four, deposits 100*l.*, for which he is to receive an annuity of 8*l.* per annum. He insures his life for 100*l.* at a premium of 2*l.* per cent. per annum, and receives, therefore, a clear annuity of 6*l.* per cent. in money. Allow the office to make 4*l.* interest on the 100*l.* deposited (which is more than any of the government securities will give), and consequently the company, by paying 8*l.* and receiving 6*l.*, makes an annual sacrifice of 2*l.* per cent. during the life of the annuitant, without the possibility, as appears to us, of redeeming the loss, for on his death the 100*l.* deposited must be repaid to the representatives, being the sum assured. What mystery there may be in this transaction it is impossible for us to unriddle. But we may observe, that the liberal annuity tables of government for the age of thirty-four, when the price of consols is 93, give an annuity for 100*l.* stock of 5*l.* 3*s.* 7*d.*, or, which is the same thing, for 100*l.* sterling, 5*l.* 11*s.* 4*d.*, making thus, by this office, a further 'sacrifice to public benefit' of 2*l.* 8*s.* 8*d.* per cent. Can this deceive any one with comprehension beyond that of an idiot? Can any one be simple enough to imagine that James Drummond and James Alexander, of Charing Cross and Carlton House Gardens (names which figure in the list of its Directors), are to be found in Baker-street, opposite the Bazaar?

"This Independent Company, established opposite the Bazaar in Baker-street, affords almost a solitary instance of an office of this kind being removed to a great distance from any other; for it is a curious feature in the localities of these institutions, to find the new offices always endeavouring to cluster round the old ones. Thus, in New Bridge-street and Chatham-place, we find no less than fifteen brisk rivals elbowing the ancient fixtures of the Rock and the Equitable. In the

new street in the City, bearing the name of King William, new Insurance Companies have sprung up like mushrooms, some of them perhaps not much better rooted than this species of fungus. It has been said that this noble street, with its splendid-*fronted* houses, consists chiefly of gin-palaces and insurance offices, twelve or thirteen of the latter squeezing round the two old-established companies, the London Life and Edinburgh. Again, in Waterloo-place and Regent-street, we find six or seven close to the Asylum and Palladium.

"There is a reason for this: the new ones, as we have observed, being comparatively unscrupulous in their reception of subjects, and outbidding each other in the diminution of premiums, follow up their scheme by being ready on the spot to entertain the applications of those *rejected* by the senior establishments. A person applies at some old office for an insurance on his life; the doctor finds him plethoric, asthmatic, consumptive, or dropsical; he tells him his life is not considered to be insurable: the disappointed stranger (or his agent) asks what he is to do, it being of the greatest importance he should effect an assurance. The answer probably is, 'Knock at the next door, where they are not quite so nice as we are.' Another finds the premium of the old office too high, and is unwilling to give it: he is recommended to the next door but one. The only chances, in fact, that most of the new offices have for obtaining business, lie in outbidding one another in the reduction of the premiums, and in receiving persons with bodily infirmities, or such as may be going to unhealthy climates; but they depend mostly on the reduction of the premiums. Now we contend that it is a fallacy to suppose that the reduction of a few shillings per cent. in the premium can be of any advantage to the insured, more especially where there is a participation of profits, while it operates as a serious drawback on the profits of the office, and consequently of the insured also. The higher the premium, and the stricter the caution in taking none but good lives, the larger will be the profits to be divided. It was by these means that the Equitable was enabled to amass its eleven or twelve millions, and to divide such an enormous share of profits among the insured. The Northampton Tables were generally its guide, and those insuring were not only required to produce testimonials of sound health, but in most cases to appear personally before a board of directors; and the consequence was, as the late Actuary tells us, that from the Equitable experience it was found that, where *three* persons were expected to die, *two* only actually died."

The above recited "Independent West Middlesex" Company now advertise, that their rates of insurance are "30 per cent. per annum lower than any other office." In producing this example of puffing, we do not intend to fix any especial stigma on that particular Company, but merely to justify our assertion, that there are many companies promising advantages which they cannot afford to give. There is one circumstance peculiar to institutions of this kind, which renders it absolutely necessary that the assured should ascertain that their business is conducted upon principles which are not only equitable to the assured, but also to the Company: when a life-insurance company commences operations, they have an immediate influx of capital, and their receipts may, for years, exceed their expenditure; but after twenty or thirty years have elapsed, and the "old gentleman with a scythe" has mowed down the early insurers, the system must be weighed in true scales, and if the payments received should prove inadequate to meet the increased expenditure, they will be found wanting, and ruin will await both company and assured. Professor De Morgan addresses the following considerations to any person who may intend to assure his life:—

"You are aware that the premium demanded of you is, avowedly, more than has hitherto been found sufficient for the purpose, the reason being, that it is impossible to settle the exact amount, on account of our not knowing whether the future and the past will coincide in giving the same law of mortality, and the same interest of money. The surplus arising from this overcharge, for the future existence of which it is hundreds to one, is now at your own disposal, and you must choose between one office and another, according to your intentions with regard to its ultimate destination. Firstly, if you doubt the general security of the plan of insurance, and are desirous of an absolute guarantee, independently of accumulations from premiums, there are offices which will, in consideration of the surplus aforesaid, pledge their proprietary capitals for the satisfaction of your ultimate demand upon them. Secondly, if, being of the opinion aforesaid, you think the whole surplus too much to pay for the guarantee, there are proprietary offices which retain a part of the profit in consideration of

the risk of their capital, and return the remainder. Thirdly, if you wish the surplus premium, as fast as it is proved to be such, to be applied in obviating the necessity of any further overcharges, there are offices which divide the profits during the life of the insured, by means of a reduction of premium. Fourthly, if you wish the surplus to accumulate, and, feeling confidence in your own life, are willing to risk losing it (the *surplus*, remember) entirely if you die young, on condition of having it proportionally increased if you live to be old, there are offices which divide all or most of the profits among old members. Fifthly, if you would prefer a certainty of profit, die when you may, there are offices which at once admit new members who die early to a full participation in all advantages. The choice between these several modes must be made by yourself, according to your own inclinations, views of fairness, or particular circumstances."

COLLIER'S FILTERING MACHINE.

To the Editor of the Mechanic and Chemist.

Sir,—In offering the following sketch of a machine, being a new mode of filtration, called "Collier's Aquemolus," manufactured at Blackwall, it may be observed to be a great improvement even on another of his own, complimented by the following letter from the New River Office, as a testimony of its merits:—

"New River Office, London,
August, 1835.

Sir,—Your letter of the 13th instant has been laid before the Directors of the New River Company, and I am ordered to say in answer, that the Company have no present intention of filtering the water before it is supplied to their tenants; they think, however, that your filter is very well calculated for doing this after it is delivered into the houses.

I am, Sir, &c.
(Signed) F. Inglis, Clerk.
To Mr. Collier, the inventor."

To effect the management hereof, of which directions are given in the form of a prospectus, reverse the instrument, open the tap, take off the cups and fill it completely with water, then restore the cups fast on; now remove the body containing the filtering materials in the tub or cistern, with the tube outside, which may then be let run at the tap. In a day or two the water will deliver itself quite bright. When to be cleansed, after some months, merely reversing the current by turning the tap inside, will have the desired effect in a few hours. The projecting piece at bottom, bent more or less, prevents the vibration, and keeps the cups always on their true level.

After Thames water has passed through the Aquemolus, no animalcule appears; and it may, perhaps, be considered as pure oxyhydrogen combined with carbonic acid. While health and longevity so much depend on the perfection of wholesome water taken inwardly, and for all culinary purposes, it should be presumed, that the prices being so moderate as a few shillings for lengths from 16 to 40 inches, the faculty may be justly rewarded by the original patentee for a wholesale introduction, even to their own loss, of such instruments to families and shipping, or wherever large supplies are required. C.

[It is to be regretted, as well as wondered at, that filtering is so little resorted to, notwithstanding the notorious impurity of the water with which this metropolis is supplied. If Mr. Collier should succeed in introducing his filters into general use, we do not hesitate to say that he will render a signal service to society.—Ed.]

CONSUMPTION OF OPIUM IN CHINA.

At the meeting of the Medico-Botanical Society, held on the 8th January, Dr. Sigmond observed, that he had on a former occasion described the effects upon the human frame of this fascinating indulgence; he had described from authorities of undoubted character, the progress from the commencement of the habit to the period at which premature decay destroyed the strongest constitution. The principal inducement for the Chinese to smoke opium instead of eating it, as usual among European and Asiatic nations, arose from the facility and the rapidity with which the intoxication is produced. When imbibed by the lungs into the system, it was conveyed with inconceivable quickness to every part of the body, and more especially to the brain, upon which its singular effects were most visible. The aroma of vegetable bodies, assisted by heat, actually entered into the circulation, most probably rendering the blood itself more liquid; it traversed every channel, and the minutest

capillary vessel became completely injected. It was rather as a matter of scientific inquiry, than as a political or financial question, that Dr. Sigmond had been led to examine such documents as might enable him to form an estimate of the quantity of opium consumed. He had found that calculations had been made as to the number of smokers, from the quantity that had been at various times imported from India, and from the revenue which the East India Company had derived from the sale of it. The increase from the year 1820 had been prodigious. The presumed number of smokers in three years at that period was 365,569, and they consumed about 4287 chests; these had increased in twelve years from 1822 to 1835 to 2,039,998, smokers, when about 12,339 chests were consumed; and it was now believed that the number was not les than twelve millions. The average consumption of each person was about seventeen and a half grains daily. The monopoly in Bengal supplies the government with a revenue of 961,293*l*. Amongst the papers he had seen, one stated that in 1837 the Company sold 16,916 chests, by which they gained 2,155,290 pounds sterling. Dr. Sigmond then proceeded to an inquiry into the effects of inhaling opium or the vapour of other vegetable substances on the brain, and to the mode by which they were taken into the system. He said, that it was not until the experiments of Majendie that it had been universally admitted, that vapour inhaled was absorbed with such rapidity, that it might be said to be brought into immediate contact with the heart and the brain through the circulation. It had been supposed that the impression was on the nervous system, and that smelling produced the effects: thus death had been ascribed to the odour of plants; in one instance, a daughter of the Count of Salin is said to have died from breathing the aroma of violets; in another, a daughter of the Bishop of Podolia, death took place from the odour of lilies. He then noticed the different herbs that, under certain circumstances, produce agreeable sensations when inhaled. Herodotus had spoken of flax, and in the East the seeds of hemp are commonly used, and are now likely to be substituted for opium. Although most of the narcotics produce a momentary pleasure when smoked, they all of them are injurious. Dr. Sigmond mentioned, that even stramonium, or the thorn apple, which has been largely employed as a cure for asthma, has injurious influence, and referred in proof to the death of General Gent, who introduced from India the practice of smoking stramonium for pulmonary affections. This habit had become not unusual even amongst those who were not affected with any disorder, but the circumstances attendant upon the death of the General after the use of his favourite herb, under symptoms that left no doubt as to its cause, put a check to its use.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 162.)

As we ascend in the scale of animal life, we find a nearer approach to distinct organs for the circulation. For instance, in the oyster you will perceive that there is a distinct heart perfect of its kind, which is an advance upon the dorsal vessel. And the same structure may be observed in the lobster. These organs, properly speaking, are not perfect hearts; they are termed *sinuses*, that is, dilatation of the vessel in which the vital fluid moves; but as they are evidently stronger in their structure than the other portions of the vessel, there is little doubt but that they supply the place of hearts. You will find the heart of the oyster without much trouble: it lies in the very centre of the fish. In the lobster it may easily be found, by removing carefully the large shell that covers the body, when it will be seen surrounded by the gills, or, as they are termed for some fanciful reason, "dead man's flesh."

In what are termed "cold-blooded animals," such as fishes and amphibious animals, the circulating organs approach still nearer to those of man. In these animals the blood is only imperfectly purified, by being brought into contact with the air. In fishes, which you are aware breathe by means of gills, the purification is not perfect, because the supply of air is limited. Water contains a considerable portion of air, as we might prove by placing a tumbler full under the receiver of an air-pump, and exhausting the receiver, when you would observe the bubbles of air rise from the water very rapidly, but still the quantity is limited; and although, therefore, all the blood of the fish is brought into contact with the water, so that it may absorb as much of the air contained in the latter as possible, yet it is not more purified than that of the frog, only *half* of whose blood comes into contact with the air. There is this difference to be remarked, however, that while the fish breathes air, through the medium of water, the frog breathes it direct. Although,

therefore, only half the blood contained in the body of the latter animal is sent to its lungs, while the whole of that of the fish is sent to its gills, which perform a similar office, they are both in the same situation with respect to the purification of the vital fluid; for what the fish has in quantity, the frog has in quality. The fish is compensated for not having the air direct, by having a greater quantity of its blood exposed to the action of the air contained in the water; and the frog is compensated for not having the whole of the vital fluid sent to its lungs, by having a supply of pure air direct from the great bulk of the atmosphere.

We perceive, therefore, how gradually the circulating organs become more complex as we ascend in the scale of being; how from being at first a mere pulsating tube, we find in a class of animals a little higher a distinct form of heart, and how this gradually becomes more complex, or, I should rather say, more perfect and beautiful, according to the class of animals in which we find it, until we come at last to man himself, in whom every thing is contrived in the most exquisite manner, to accomplish the object for which it is intended. We will now, therefore, take into consideration the structure and use of the organs by which the circulation is effected in ourselves; and as we proceed, I will take the opportunity of showing you more distinctly their superior perfection over those of every other class of animals.

The organs of the circulation in man have two objects to perform: first, to cause the blood to circulate through the lungs, in order that it may be purified, as I have just mentioned; and, secondly, to cause it to circulate through the body, for the purpose of supplying the various organs with their requisite degree of nourishment. To effect these objects, it is necessary, first, that there should be an organ capable of forcing the blood in the direction required—this is the heart; and, secondly, a system of vessels to convey the fluid from and back again to that organ—these are the arteries and veins.

The heart is a strong muscular body, consisting of four distinct chambers, two of which, called the right and left *auricles*, act as *receivers* of the blood,—one receiving it from the body, and the other from the lungs; and the other two chambers, called the right and left *ventricles*, act as a kind of *forcing pumps*, to send the blood out from the heart, the right ventricle sending it to the lungs, and the left forcing it over the whole body. The use of these parts may be understood from the following description:—First, the blood is received from all parts of the body in two great veins, which, uniting together, form the *right auricle*. When this becomes full, it contracts, or shortens itself in every direction, so that its contents are forced into the chamber immediately below it, on the right-hand side, called from this circumstance the *right ventricle*. You might at first suppose, that as much blood would pass back again into the veins when the auricle contracted, as into the ventricle; but this is prevented by a very beautiful contrivance of *valves*, which are so situated, that while they allow the blood to pass *into* the auricle from the veins, they will not permit it to pass back. Of these valves, however, I shall have to speak more hereafter; and, therefore, I will not allude more particularly to them just now, except to mention, that they are placed at the entrance of all the chambers, and that their office in each case is the same, namely, to permit the blood to pass in, but prevent its returning. When, therefore, the right ventricle contracts, it forces its contents onwards through a vessel which divides into two branches, one going to each of the lungs, and subsequently dividing into innumerable ramifications. The use of the right ventricle, therefore, is to force the blood into the lungs, in order that it may come into contact with the air and be purified; for I should mention, that the blood in its passage through the body loses its vital energy, and becomes contaminated. It is necessary, therefore, before it is again sent out to the different organs, that its vitality should be renewed; and this is effected by its contact with the air in the lungs. When I have to describe the process of respiration, you will understand better the part of the subject I am now alluding to, but at present, what I have stated will be sufficient for you to comprehend the reason why it is necessary the right ventricle should send the blood to the lungs. When the chemical change which takes place there has been perfected, the blood returns through the pulmonary veins to the *left auricle*,—a similar chamber to the right auricle, only situated on the left side of the heart; and when it is full, it contracts in a similar manner, forcing the blood into the *left ventricle* immediately below it. This is the strongest chamber of the heart; its fleshy walls are remarkably thick and strong, and its power is very great. This is necessary, because it is this ventricle which forces the blood to every part of the body; and it is easy to imagine, that it requires a

powerful force to impel the vital stream to the remotest parts of the system. This, then, is a description of the various parts of the heart and their uses. First, the right auricle receives the blood from all parts of the body; secondly, it passes it into the right ventricle; thirdly, this contracts and forces it over the surface of the lungs, where it is purified; fourthly, it returns by the pulmonary veins to the left auricle; fifthly, this contracting sends it into the left ventricle; and, sixthly, this in its turn contracts, and forces the blood over the whole body, to supply every organ and every part with nourishment and life. Nothing can be more beautiful than the regularity with which all these actions are performed—each part fulfilling its office with a precision that it will be in vain to look for in any machinery of human contrivance; and when we reflect that it is on this regularity and precision that our health and happiness entirely depend, we cannot fail to experience the highest degree of admiration and reverence for that great and benevolent First Cause, which has so ordered all things together for our enjoyment. "The wisdom of the Creator is in nothing seen more gloriously than in the heart! and how well does it execute its office!" says Paley. "An anatomist who understood the structure of the heart, might say beforehand that it would play; but he would expect, I think, from the complexity of its mechanism, and the delicacy of many of its parts, that it should always be liable to derangement, or that it would soon work itself out. Yet shall this wonderful machine go, night and day, for eighty years together, at the rate of a hundred thousand strokes every twenty-four hours, having at every stroke a great resistance to overcome; and shall continue this action for this length of time, without disorder and without weariness." What study to which you could direct your attention, would furnish you with any example like this of the power, wisdom, and benevolence of the Creator?

The situation of the heart is not so well understood as persons generally suppose. Most persons imagine that it lies entirely on the left side, in consequence of the palpitation being felt most strongly there; but, in fact, it lies nearly in the centre of the chest, with its apex directed against the left ribs; and it is this part beating against the ribs, which has led to the common opinion of the heart being entirely on the left side.

The heart has a more complex appearance than it would otherwise present, if its four chambers were not united together. As far as its principle of action is concerned, these chambers might have been entirely distinct, one being in one part of the body, and another in another part, provided there were proper vessels connecting them together. But there is a great advantage from the union in regard to strength, and accordingly they are found united. In some animals, however, they are found separated to a certain extent, probably in consequence of some greater advantage being derived from their separation. I have seen, for instance, in the Museum of the College of Surgeons, the heart of a dugong, which is divided into two distinct portions, attached together only at the upper part.

The muscular structure of the heart requires a few words in explanation before I pass from this part of the subject. The four cavities are formed by the union, or rather interlacing of an innumerable number of muscular fibres, which are so interwoven with each other, that they acquire great additional strength in consequence; and one part is thus to a certain extent made subservient to another. In order for you to understand clearly the manner in which these muscular fibres act, it may be necessary to mention, that it is the property of muscle, or, as it is commonly termed, flesh, to shorten fibres when stimulated. All muscle is composed of a number of fibres, which may easily be seen in meat when it is overcooked; and when these fibres are stimulated, they shorten themselves, so as to bring any two points to which they may be attached, closer together. All the motions of the body depend on the action of the muscles, and of course the heart forms no exception. The muscular fibres of this organ are stronger and more dense than in any other part of the body, and they have all of them an oblique direction, some being spiral, and others almost circular. When they are stimulated to action, they consequently squeeze the auricles and ventricles, and by this means empty them of their contents. The irritability of the muscles of the heart, or their disposition to shorten themselves when stimulated, is very extraordinary, and it is even stronger in some of the lower animals than in man. John Bell says, they are chiefly the amphibious animals, as they are called, needing little air, which have this power of retaining life; no stimuli seems to exhaust them; there seems especially to be no end to the action of the heart. A newt's or a toad's heart beats for days after the creature dies. A frog, in performing experiments, is often neglected, its limbs mangled, and its head

gone,—perhaps its spinal marrow cut across; and yet for a whole night and a day its heart will not cease beating. It seems as if nothing but loss of organization could make this irritable muscle cease to act. Thus in human beings, it is long after apparent drowning, or other suffocation, before the principle of life is gone; and long after the death of the body, before the heart be dead. In fact, the heart is the part first to live and last to die.

The external appearance of this important organ must be so well known to all of you, that it is unnecessary I should describe it; the interior, however, requires a different notice. Each of the four cavities is lined with a very delicate and exquisitely sensible membrane, on the stimulus of which depends the action of the muscles. For a long time after death, if this membrane be excited by the contact of any foreign substance, it will cause the heart to contract with great force. Some physiologists have pricked it slightly with a needle, and this caused the muscular fibres to contract so violently, as completely to bury the needle in their substance. Its natural stimulus, however, is the blood; and whensoever, therefore, either of the chambers become filled with it, they are stimulated to contract almost as powerfully as by the prick of a needle, and by this means squeeze the vital fluid out of them as before mentioned.

I cannot conclude this part of the subject, without drawing your attention most particularly to the wonderful fact I have just mentioned. *The blood itself is the stimulus which causes the heart to contract*, and, in point of fact, the blood is the immediate cause of its own action! In no other department of science can I direct you to any fact so wonderful as this. In the revolution of the planets, the constant return of the seasons, the regular succession of day and night—in all these we have astounding instances of the magnificent power of the great Creator of all; but to my mind there is something even yet more wonderful than these, in the means by which the blood creates for itself a power by which it shall be put in action. When we reflect on the innumerable list of casualties and evils "which flesh is heir to," and consider by how many thousand accidents the action of the heart,—the prime mover and regulator of that wonderful piece of mechanism the human body,—might have been brought to a sudden pause, did it depend on any contrivances independent of itself, we cannot, I think, fail to be struck with the deepest wonder and astonishment at the mode in which any contingency of the kind has been provided against, and which, by making the blood the cause of its own circulation, has given us as strong an assurance, as by "that miracle of beauty," the rainbow in the heavens, that, during summer and winter, spring time and harvest, our happiness and enjoyment are secured so far as is compatible with the existing laws of nature. Surely no one will say after this, that a subject capable of directing your minds to the consideration of such topics as these, is unfit for the attention of ladies; on the contrary, I trust, as far as you are concerned at least, that a very different opinion will be formed; and I sincerely hope that nothing during the course of this lecture has escaped from me, that could in any way offend even the most refined taste, as I assure you that it is only in the mode of treating the subject, and not in the subject itself, that any cause for censure can be found.

In my next lecture I shall conclude the description of the organs of the circulation, and endeavour to explain a few of the phenomena connected with their action.

REVIEW.

The Practical Chemist's Pocket Guide; being an Easy Introduction to the Study of Chemistry. By WILLIAM HOPE, M. D., Operative Chemist. Glasgow: W. R. M'Phun.

IN this little volume, much valuable information is condensed into a small space; the author says his object was "to make a useful book of it," and this he certainly has done. The following extract will not only serve to recommend the work, but will be found interesting to many of our readers:—

"*Carbonic Acid.*—Carbonic acid was discovered by the late Dr. Black, of Edinburgh, in 1757, under the name of *fixed air*, which is still a familiar name. It was the first gas that was discovered.

It exists in a great variety of substances. All that class of salts called carbonates contain it, and it is generally from them that we obtain it for experiments. Thus marble—which is a carbonate of lime—yields it in abundance by the addition of some stronger acid, which will unite the lime and expel the carbonic acid.

Exp. The most convenient vessel for preparing this gas, is the one described for preparing hydrogen. Having put into the bottle a quantity of marble, in small lumps, pour muriatic acid, diluted with three

times its weight in water, into the funnel; it will come in contact with the carbonate of lime, and, uniting with it, will expel the carbonic acid, which may be collected in glass receivers over water. It may also be prepared by uniting the ingredients directly as in the experiment for burning charcoal in oxygen, where the product is carbonic acid.

Carbonic acid is a colourless gas at the ordinary temperature and pressure of the atmosphere; and is generally described as inodorous, though its presence can easily be ascertained from its smell alone. It is heavier than air; so that it may be collected in jars, turned upwards, by leading the tube to the bottom of the jar, and may be poured from one vessel to another, like water.

It will not support respiration. A small animal, such as a mouse, confined in the gas, immediately perishes. An atmosphere containing only one-fifth or one-sixth part of carbonic acid, will scarcely support the combustion of a candle; and it is always unsafe to venture into any place where a candle will not burn.

Obs. 1. Cases of death, from exposure to this gas, have been so frequent, that no opportunity should be lost in enforcing upon the mind of the public the necessity of caution upon this subject. Charcoal, from its cleanliness with regard to smoke, and from the freeness of its combustion, is the material most generally used where such accidents have occurred. Though the products of the combustion of anthracite and bituminous coal are the same as those from the combustion of charcoal, yet the draught required in the former case is so great as to carry away all the noxious gases in the chimney. The mischief has generally been done in small rooms, not supplied with a chimney, or any other means of ventilation. In these apartments a small portable furnace, or a chafing-dish of lighted charcoal, is placed, and the door is generally closed to preserve the temperature of the room. The first effect of the gas is slight headach, accompanied with giddiness, and almost immediately followed by insensibility; and, unless assistance be immediately afforded, death soon ensues.

2. Another source of danger from carbonic acid is, where anthracite is burned in a close stove supplied with a damper that fits closely, and when the fuel is well lighted, and in a state of glowing combustion, the damper is closed, and the gaseous products of the combustion are in consequence forced into the apartment.

Carbonic acid is always present in the atmosphere; even in the highest regions penetrated by man, it is found in about the same proportion as on the surface of the earth, viz., to the amount of about one-fifteen-hundredth part of the bulk.

Exp. Its presence may be proved by exposing lime-water to the air, in an open vessel; the carbonic acid in the atmosphere will unite with the lime, and a thin pellicle of carbonate of lime will cover its surface. From twelve to twenty-four hours is a sufficient time to make the experiment. Lime-water is one of the most delicate tests of the presence of carbonic acid; that formed in respiration is easily shown, by forcing the air from the lungs by means of a tube through this liquid.

The sources of the carbonic acid in the atmosphere have been mentioned above. It is frequently found in low situations, such as mines, old wells, caverns, &c., where it is erroneously supposed to accumulate by separation from the air, in consequence of its great weight.

Obs. From the facts that it is found in the highest regions of the air, and also, when effectually removed from old wells, will in a few days or weeks accumulate, we seem justified in the conclusion, that the carbonic acid found in low situations is liberated near the spot where it is found.

It might naturally be supposed, that from the many sources of carbonic acid, its proportion in the air would increase; but the fact is otherwise. It remains the same. The growth of vegetables—which is the only known process for taking up carbonic acid from the atmosphere—regulates the relative proportion, keeping it always the same.

Obs. The process of vegetation in relation to respiration and combustion, is a remarkable instance of the evidence of design. In this process, the carbonic acid of the air is taken up by the vegetable, the carbon is deposited, forming a part of its substance, while the oxygen is given out to keep up a supply for the processes of respiration and combustion. Thus the chief food of plants and vegetables is that which is absolutely poisonous to animals, and destructive to combustion; while that which is rejected as useless to plants, is the only nourishment for respiration and combustion.

Carbonic acid is absorbed by water, which takes up its own bulk of the gas, at the ordinary temperature and pressure of the atmosphere; but it will take up much more, if the pressure be increased. The quantity absorbed is precisely as the

pressure: that is, water dissolves twice its volume when the pressure is doubled, and three times its volume when the pressure is tripled.

Water that has been saturated with carbonic acid, requires an agreeable and lively taste, and a sparkling appearance.

Illust. Such is the case with the soda water drawn from the fountains, where the gas has been forced in by a forcing-pump, until the water has taken up some four or six times its bulk, increasing the pressure in the same proportion. The effervescence which takes place on opening a bottle of spruce-beer, cider, or brisk champagne, is owing to the escape of carbonic acid gas. Beer, porter, and ale, owe their agreeable and pungent taste, in a great measure, to the presence of this acid; and by losing it from exposure to air, they become stale.

In all cases of fermentation in malt liquors, wines, cider, yeast, &c., the changes produced are owing to the formation and escape of carbonic acid.

Carbonic acid, at ordinary temperatures, by sufficient pressure, is reduced to a transparent liquid. At the meeting of the *British Association* at Newcastle, in 1838, among the most attractive of the scientific novelties exhibited, was the solidification of carbonic acid gas, by means of apparatus invented by Robert Adams, Esq. The apparatus consists of a strong wrought-iron vessel, in appearance like a swivel-gun, two feet long, and six inches in diameter, suspended by trunnions, on an iron frame; of a vessel similar in form and size, but mounted perpendicularly on a flat stand; and of two pumps worked by powerful levers, together with the needful valves and connecting tubes. Into the generator, or suspended vessel, are put proper quantities of bicarbonate of soda and warm water; a long open tube is also inserted, containing sulphuric acid; the mouth is closed with a screw valve, and the generator being rapidly whirled round on its trunnions, the sulphuric acid flows out and is mixed with the solution of bicarbonate of soda. The carbonic acid disengaged, having no room to expand, is condensed into a liquid. So far the apparatus resembles that first employed for the same purpose by M. Thellussier in Paris. But stopping short here, Thellussier could only make use of about one-third of the carbonic acid disengaged, while Mr. Adams, by pumping it into the second vessel, obtains nearly the whole. On allowing this liquid carbonic acid to escape through a box, or hollow brass cylinder, into the atmosphere, the instantaneous evaporation of one portion causes it to absorb so much caloric as to solidify the remainder. The solid carbonic acid resembles, in appearance and texture, newly-fallen snow, or small hail; it evaporates rapidly, but not instantly; from the atmosphere of gas around it, preventing close contact, its intense coldness is not immediately felt, but the brass box in which it is collected, or the solid acid itself when long held, blisters the skin like a hot iron. By placing a portion of the solid acid on a few pounds of mercury, moistened with ether to improve the conduction, the mercury soon becomes solid, and thus the freezing of mercury—an experiment which many chemists have never seen—is performed rapidly on a large scale, and with the greatest ease and certainty. Several curious experiments were shown by means of the frozen mercury; it was doubled up and placed in water, which instantly froze, while the mercury returned to its ordinary state of fluid. But the most remarkable occurred accidentally: on touching a mass of cold iron, the mercury fused, and ran down from so good a conductor, like lead or tin in a furnace. Professor Graham did not speak too strongly when he said that such an apparatus would become as needful in the laboratory for the production of cold, as a furnace for producing heat. But the circumstance of most consequence in relation to its practical employment is, that at a temperature of 150 degrees the liquid acid exerts an expansive force of 70 atmospheres, or 1050 pounds on the square inch; and every increase of a single degree of temperature augments the pressure by upwards of an atmosphere, or 15 pounds on the inch. The iron cylinders are proved before being used, by a pressure of 150 atmospheres, and Mr. West states, that remembering the enormous power obtained, and observing the perfect ease and apparent safety with which this force is managed, he, contrary to his previous views, no longer considers the use of liquid carbonic acid, as a moving power, to be at all chimerical. Should it be so applied with success, our present locomotives would be discarded, stoppages for water would be needless, and on long lines of railway, or for long voyages, steam would be superseded by carbonic acid."

Selenium.—This is an elementary substance, of the colour of black lead, and about four times heavier than water, tasteless and inodorous. It was discovered by Professor Berzelius, of Stockholm, in 1818, in combination with an ore of iron, found in the mines of Fahlun, in Sweden.

THE CHEMIST.

NEW METHOD OF PROCURING CHLORINE.

To the Editor of the Mechanic and Chemist.

Sir,—A new fact often leads to great improvements; and being always willing to communicate (through the medium of your widely-circulated magazine) any improvement in science or art, I shall consider my time not altogether lost in describing to you a new method of making chlorine, which I have practised for the last two years, and which I can strongly recommend to the chemical part of your correspondents. It consists in pouring six equivalents of muriatic acid upon one of chloride of potass; the reaction which takes place is exemplified by the following diagram:—

1 Chlorate of Potass.....	5 Chloric acid	1 Chlorine	
		5 Oxygen	1 Chloride of Potassium.
	1 Potass	1 Potassium	
		1 Oxygen	
6 Muriatic acid	6 Hydrogen		6 Water
	6 Chlorine.....		Liberated

By this diagram, you will see that 1 equivalent of chlorate of potass is a compound of 5 equivalents of chloric acid, and 1 of potass—chloric acid being composed of 1 chlorine and 5 oxygen; and potass, 1 potassium and oxygen; this combines with six equivalents of muriatic acid, a compound of 6 hydrogen and 6 chlorine. The 1 equivalent of chlorine in the chloric acid, combines with the 1 equivalent of potassium in the potass, and forms 1 equivalent of chloride of potassium; the 5 of oxygen in the chloric acid, and the 1 in the potass, combine with the 6 of hydrogen in the muriatic acid, and form 6 of water; the six equivalents of chlorine in the muriatic acid being set at liberty. By this means we have all the chlorine contained in the muriatic acid at our disposal, which is more than can be produced by any other process.

Chlorate of potass is a very expensive salt; but then the quantity required is so small in comparison to the gas produced, that the expense will be found to be very little more. Under ordinary circumstances it requires no heat; but if we want to produce it rapidly, a moderate heat may be applied at the commencement. Great care must be taken to add full 6 equivalents of muriatic acid, protoxide of chlorine being produced if we have less.

Felix Weiss.

Liverpool.

ARITHMETICAL QUESTIONS.

To the Editor of the Mechanic and Chemist.

Sir,—You will oblige me by inserting the following, if suitable:—

Taking 8.878 as the specific gravity of copper, $\frac{27.7274}{8.878}$ = the number of cubic inches in a lb. of copper, the reciprocal of which $\frac{8.878}{27.7274} = .32$ for a multiplier. So $\frac{7.248}{27.7274} = .26$ ditto for iron; and so for all other bodies.

Also, $\frac{1}{27.7274} = .036$ ditto for water.

Then $.5236 \times 8^3 \times .32 = 85.7866$ weight of the solid globe of copper.
$.2618 \times 8^3 \times .036 = 4.8254$ ditto of hemisphere of water.

80.9612 ditto of globe of copper equal to the internal cavity.

Then $\frac{80.9612}{.5236 \times .32} = 483 +$ and $\sqrt[3]{483} =$, &c. &c.

I have worked out the question, in compliance with "Sherwood's suggestion, but do not think he will find it shorter or simpler. It is the usual method for converting division into multiplication. In giving artificial numbers, the method of ob-

taining them should always be shown, otherwise they will not be understood, except by the mathematician, who, of course, can construct them for himself. I would also beg to be allowed to express my opinion on the subject of multiplying pounds by shillings, &c. The very nature of multiplication, which is simply a compendious way of addition, precludes the possibility of such operations. What idea can a person attach to 5 shillings times 3 pounds; or 8 lions times 9 elephants? As to duodecimals, every one who knows anything of arithmetic, must be well aware that the method used is but a conventional way of obtaining different fractions of the multiplicand. With respect to the querist wishing to know the method by which pounds, shillings, and pence *could* be multiplied by pounds, shillings, and pence, as stated by "O. P.", it may readily be conceded that such was his desire; but then the thing *cannot be done*, and this we maintain in defiance of Cocker and Wyngate, and the world besides, if necessary. No authority can justify absurdity. A rectangular piece of board may measure 6 feet by 3 feet 4 inches, and we may wish to ascertain the superficial content: we accordingly multiply 6 feet by $3\frac{1}{3}$, or duodecimally by 3 and $\frac{4}{12}$; but the $3\frac{1}{3}$ becomes an abstract number, and the feet have nothing further to do with it than determining whether it be an integer or a fraction. If the length be taken in feet, it is an integer; if 2 yards be regarded as the length, it becomes a fraction $\frac{3\frac{1}{3}}{3}$ or $\frac{10}{9}$. In the former instance, 6 feet $\times 3\frac{1}{3} = 20$ feet, and in the latter 2 yards $\times \frac{10}{9} = 2\frac{2}{9}$ yards.

I remain yours, &c.

W. W.

[We most cordially agree with our talented and esteemed correspondent, and maintain our position with him "against the world, if necessary." An anecdote is related of Dr. Johnson, who being once at a tea party, at which Mrs. Thrale presided, that lady, in the earnestness of her argument, forgot to put the tea into the pot, and was filling the cups with clear water; the Doctor observing this, said, "Madam, you think you are making tea, but you are making water." Such is the case with those who think they are multiplying pounds by shillings, when in reality they are multiplying pounds by twentieths of a pound; a distinction which some may not comprehend, but such we should pronounce unfit for mathematical pursuits, and, *à fortiori*, for mathematical controversy.—Ed.]

MISCELLANEA.

MAKING COFFEE, BY DR. RATIER.

Take four ounces of good coffee, properly roasted and ground. Dilute it in two glasses of cold water, with a spoon. Let it steep all night, covering the vessel which contains it. Next day pour this pap with care on fine linen placed in a glass funnel in a bottle. You have an extremely strong effusion, of which a single spoonful, poured in a cup of boiling milk, is sufficient to give the whole a delightful perfume. One part of this infusion and two parts of water, put on the fire until it just boils, gives a water coffee of superb colour and perfect taste. It may indeed be conceived, that coffee, treated cold, may not have parted with every portion of its aromatic principle. Now, can cold water draw from coffee all that can be obtained from it? I answer yes! approved by experience. Indeed I have tried the process related above with boiling and with cold water, and I have assured myself by comparison, that the powder drained by the cold water, and treated then with boiling water, gave nothing but a water slightly tinted with yellow, and devoid of odour and flavour. It is besides proper to pass an equal quantity of water to the first, over the grounds, in order that the second water may serve for new powder. There is thus both economy of fuel and time, since the operation is done at once, and constantly succeeds if done in this manner. This process is not spoilt in the boiling, nor can it frequently overflow, as in the apparatus called Marize, and others which answer the purpose well, but are expensive to purchase, and require repairs. As for myself, two small decanters of glass, and a funnel of the same material, compose all my apparatus. One of the decanters contains the prepared coffee, and has a ground stopper. The other, in which the funnel is placed, receives the second water, and in its turn contains the coffee, and thus both are used in succession: all the care required is in passing a little water through them at times. Every person who has tasted my coffee, whether made with water or milk, has found it of a superior quality. I am astonished that so simple a process has not been adopted. For the coffee-houses it would have the great advantage of always having coffee ready made, not by adding water to the milk, which contains enough already, or making the coffee from the hand to mouth, but in a manner which none of the qualities sought for by true amateurs are lost. I may here mention, that the process was suggested to me in reading a memoir of M. Boullay, apothecary at Paris, upon the preparation of tinctures and extracts by a method which he calls "deplacement."—*Quarterly Journal of Agriculture.*

Potash.—This substance is known by the names of potassa and kali, but is mostly called vegetable alkali. It is obtained from vegetable substances in various ways. Pearlash, which is impure potassa, is made by evaporating the lix-

ivium of the ashes of plants, and afterwards calcining what remains. Wine lees yield much potash by combustion: this kind is the purest. Saltpetre, fused on charcoal, throws off nitric acid, and leaves alkali, which, when pure, turns itself into a liquid, very foolishly called oil of tartar. Salt of tartar is obtained by repeated combustions and evaporations of vegetable alkali. The saline products of 250 lbs. of ashes of various vegetables are as follow:—

Elm	41 lbs.	6 oz.
Box	19	8
Wormwood	187	
Oak	27	12
Fir	33	
Heaths	28	12
Aspen	12	12
Fumitory	90	
Beech	54	12

The ounces in the above table must not be looked upon as quite accurate. Lixivium, which has been referred to, is the liquor in which saline substances are dissolved. WM. V——E.

Advantages of the Mulberry in Maritime Situations.—It has long been matter of regret to the admirers of maritime situations, that the baneful effects of the sea atmosphere upon almost every species of shrub and tree, has caused a particular nakedness and desolation in sea-coast views. The sycamore, hardy as it is acknowledged to be, succeeds but in part: it never assumes that rich and green flakey foliage, which constitute its peculiar beauty. Even the oak, that stately ornament of more sheltered spots, absolutely refuses to grace these dreary scenes; and the elm, tall and branching in other situations, here shrinks from the blast, and dwindles into insignificance. There is, however, one tree capable of resisting the malign influences of a sea atmosphere, and that is the mulberry: indeed, it not only defies the enemy, but even delights in its exposed situation, throwing out its able limbs in all directions and assuming a foliage rich, full, and tufted to its topmast boughs. These trees are almost abundantly prolific, and in all seasons the fruit arrives at perfection. It is therefore most singular, that the cultivation of this beautiful and useful tree, should have become so much neglected, particularly as it would thus flourish in a situation where all other trees fail, and enliven, by its noble appearance, the barren monotonous scene exhibited on our sea beaches.

Insect Ingenuity.—Insects inherit, in common with the superior animals, a degree of instinct that seems more extraordinary when displayed by creatures apparently so insignificant, and so ill qualified for the exertion of that faculty. Their usefulness to mankind, although, perhaps, not generally noticed or appreciated, is far from being contemptible; and the instinctive forethought which they possess, when exerted for the welfare of their progeny, seems almost miraculous. The nut-weevil, when prepared to deposit her eggs, selects the green hazel-nut when its shell is soft and easily penetrated; this she pierces with her proboscis, and drops her egg into the nut through this perforation; this she continues to do, selecting a separate nut for each of her eggs, until her stock is exhausted. The nut not being materially injured, continues to grow, and when the egg is hatched, the maggot which is produced from it finds its food ready ripened for its use. When the mature nut falls to the ground, the insect crawls out by a hole which it gnaws in the side of the nut, and ultimately assumes the form of a winged insect of the beetle kind. The spirex, or ichneumon wasp, pursues an almost similar course: it deposits its egg in a hole which it bores in the sand; it then seeks out a small green caterpillar, which is found on the leaves of cabbage plants, which it slightly punctures with its sting, but so slightly as not to destroy life; it then rolls it up in a circle, and places it in the sand immediately over its egg, and continues this course until it has placed twelve caterpillars, one over the other, in the nest. It repeats this process over all its eggs; it then covers up the holes and dies. The maggot hatched from the egg feeds successively on the twelve caterpillars, and by the time it has finished the last, it is fitted for the state of a chrysalis, into which it is converted, and ultimately becomes a winged insect. ALPHA.

Electricity.—M. Rousseau proposes to ascertain the purity of certain substances, and to detect any adulterations in them, by measuring their conducting power for electricity. Some years ago he described a simple apparatus, by means of which the purity of olive oil might be tested on similar principles. He now states, that by these means any adulterations in chocolate or coffee may be readily detected: he finds that pure chocolate is a non-conductor or insulator of electricity, but that in proportion to the quantity of farina or feculæ matter with which it is adulterated, the more easily does it conduct electricity; and in the same way he states that coffee is an insulator, whilst chicory, with which it is often mixed, is an excellent conductor, and hence the presence of only a small quantity of that substance is easily detected in coffee by its increased conducting power. M. Rousseau also considers, that this test may be applied with advantage to the examination of pharmaceutical extracts and preparations, because they very much differ in conducting power, and therefore any mixture or adulteration will be readily discovered.—*Athenæum.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street.—Thursday, Jan. 30, Edward W. Elton, Esq., on the Genius and Influence of Shakspeare. At half-past eight.

Poplar Institution, East India-road.—Tuesday, Jan. 28, J. Mitchell, Esq., LL. D., on the History of Turkey. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney-road.—Tuesday, Jan. 28, Quarterly Meeting of the Members. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross-street.—Monday, Jan. 27, J. T. Strange, Esq., on Magnetism and Electro-Magnetism. At half-past eight precisely.

QUERIES.

Sir,—As I believe one object of your journal is to afford cheap communication between the mechanics of this country, I hope you will allow me to ask some of your very intelligent correspondents the following questions; namely,—Is there any treatise on logarithms whose natural numbers go beyond 10,000, and also its price? Can they recommend me to a good treatise on cotton-spinning, and also its price? A good treatise on mechanics; also its price? How can I calculate the power of a steam-engine; and what proportion should the boiler bear to the diameter of the cylinder? I wish also to ask some of your mathematical correspondents the following questions, namely,—Allowing the clock fingers to be together at 12 o'clock, how soon will the fingers be the legs of a right-angled triangle? There are three wheels, whose numbers of teeth are 16, 112, 14, respectively; the 16 wheel turns the 112, and the 112 turns the 14; I want to know how many revolutions each will make before they come to the same point whence they started? Operative.

[When the minute hand arrives at 3, the hour hand has advanced $\frac{1}{12}$ of the quadrant; the minute hand must, therefore, advance $\frac{1}{12}$ of the quadrant beyond the 3; but during this last process, the hour hand has again advanced $\frac{1}{12}$ of $\frac{1}{12}$ or $\frac{1}{144}$, and so on without end, forming a series (the whole quadrant being the integer), $1 + \frac{1}{12} + \frac{1}{144} + \frac{1}{1728} + \frac{1}{21736}$, &c. $= 1.0909$, &c. Now if this series be carried on till the two hands are at right angles to each other, its ultimate amount is attained, and found to be $1\frac{1}{11}$. The accuracy of this result may be proved by another mode of computation, which gives the exact place without any approximative expression. When the minute hand has performed nine revolutions, the hour hand has advanced to 9, which is exactly three quadrants distant from the point of departure; therefore, commencing at the point where the two hands are together, taking the four quadratic positions, 0°, 90°, 180°, and 270°, 33 of those positions must occur during the nine revolutions of the minute hand; therefore, $\frac{36}{33}$ is the exact place of the minute hand at the first quadrature; and this, reduced to time, makes 16*m*. 21*s*. $\frac{9}{11}$. But there is another mode of calculation still more clear and easy:—The distance of the minute hand from the 3, must, by the hypothesis, be equal to the distance of the hour hand from the 12; also the time indicated by the minute-hand must be equal to the time indicated by the hour-hand; and it is clear, from the construction of the clock, that the distance of the hour hand from the 12, is $\frac{1}{12}$ that of the minute hand from 12; therefore, rejecting the space the minute hand has passed beyond 3, we have the space between the hour hand and the 12, $= \frac{1}{11}$ of the perfect quadrant, which, estimated according to the hour hand's value of position, will give 16*m*. 21*s*. $\frac{9}{11}$, the exact time at which the two hands are first perpendicular to each other, which was required.

The question concerning the wheels requires no calculation, since it is evident, at the first glance, that one revolution of the wheel 112 will produce seven revolutions of the wheel 16, and 8 of the wheel 14: the answer, therefore, is 7, 1, 8.—Ed.]

Where can I procure proper metal for the serapline, not subject to corrosion or breaking, and will stand well in tune? What is the best metal for the above? If steel be used, is there any liquid composition to prevent rust that could be applied after the tongues are tuned. I have used brass (milled), but not hammer-hardened, as recommended for the accordian; also German silver, both of which would not stand in tune, and often broke during playing. I have used steel, prepared by the watch-spring makers; it stands well in tune, but liable to corrosion, and sometimes breaking. I am now constructing another; and should any of your intelligent correspondents be kind enough to give me the information solicited, it will render great service to

A Subscriber.

1. How to make hydrosulphurate of iron? 2. How to prepare hare and rabbit skins, so that the fur will not come off? 3. How to make modelling wax a flesh colour? 4. The cheapest method of bleaching coloured calicos? 5. How to erase printing ink from paper without damaging the paper? H. Dinham.

I. In what way can I make a scale on ivory for a thermometer; that is to say, what are the tools used in making the lines and figures, so as to give them that black appearance, and the lines equal in their distances from each other? If an instrument is used, where can I purchase it? 2. What are the rules laid down in geometry for drawing a scale for thermometer, &c., on paper?

H. B. N.

How to tin small articles of iron, such as tacks, &c., in quantities, without their adhering?

W. G. B.

In what manner is the painting (if I may so call it) on Delph and China ware put on, which daily excites our admiration, both for its accuracy and beauty? John Terry.

A full account of the manufacture and composition of Congreve matches?

Chelsea. A Subscriber.

What will have a sparkling effect upon a transparency by night? R. J. P.

How to prepare ink for printing on linen with type? P. Y. H. U.

The easiest and best method of dyeing silk a Prussian blue? C. D.

The diameter of the safety-valve of a steam-engine boiler given, is 3 inches, and loaded 10lbs. per inch; required the internal pressure of the boiler, when the valve is raised (by the internal pressure) 1-tenth, 2-tenths, 3-tenths, 4-tenths, 5 tenths, and 6-tenths of an inch? J. M. L.

The easiest and best way of ascertaining the component parts of manganese?

A Subscriber.

The best and easiest method of making tallow hard, something like wax? E. F. D.

What gas that is which takes fire on coming in contact with the air, and what are the articles necessary to make it? I have seen it made in a beer glass, as an imitation of the Jack o' Lanthorn or Will o' the Wisp, when the bubbles of gas, on coming to the surface, ignited. In Reid's "Rudiments of Chemistry," there is, I believe, a method of making it, but by following it I should be obliged to use a retort, &c. If there is one method more simple than another, I should feel obliged by your giving it me. Mott.

1. How to refine rosin, such as is used for violins? 2. How to make deep gold, pale gold, and silver bronze powders? 3. How to colour and varnish violins dark and yellow; also what kind of varnish is used? 4. How to make small lead piping? 5. How to temper chisels, such as are used for cutting mill-stones? 6. How to weld cast steel? 7. How to promote the growth of hair? E. Ledger.

ANSWERS TO QUERIES.

"Ireland" can call any evening after dark at 42, Upper York-street, Bryanston-square, where he can have that information my humble abilities will afford respecting mammotive carriages. I commenced one upon an improved principle; but through unforeseen circumstances I was obliged to discontinue it, not having the conveniences I had previously. I now should be glad to dispose of it. The wheels are very light, and six feet in height.

To fill Decayed Teeth.—Some time ago an inquiry was made for succedaneum for decayed teeth; I have tried tea lead, after having been doubled several times, and run through the rollers of a mill, until it is as thin as possible, to have the desired effect; likewise gum shellac made warm, and put into the hollow; but the other is the best, it requires no heat. W. U.

To make White Varnish.—Rectified spirits of wine, 2 gallons; gum sundarack, 5 lbs.; gum mastic, 1 lb; gum anime, 4 oz. Put them in a clean bottle to dissolve in a warm place, frequently shaking it till dissolved; then strain it through a lawn sieve, and it is fit for use.

H. Dinham.

In answer to "R. H.", if I understand him right, he wants a working model of a steam engine and crushing-mill, together with a clarifying apparatus. If he will inform me the size and power required, with other necessary information, he may hear of something that will answer his purpose. Charles Coxell.

Clap Gate, Bowling green-walk, Worcester.

TO CORRESPONDENTS.

T. M * * s.—*When tin articles become tarnished or soiled with smoke, the best method of restoring the polish, is to rub them with a piece of woollen cloth dipped in sperm oil; when the stains are entirely removed, wipe them quite dry, and polish with a piece of linen rag and whitening.*

J. B.—*The significations of Christian names which he has sent us are too incorrect for insertion:* Adelaide *does not signify a princess, but merely* of noble birth, *from the German* Adel *(noble).* Henry, *he says, is from the German, and means a rich lord; there is no such word in German; it is probably derived from the Greek* Ηυρεα, *which signifies bold and manly.* Margarite *he also derives from the German, though the word is clearly taken from the Latin* margarita, *a pearl.*

G. H. W. *wishes to know the most effectual and economical method of preventing the noise and vibration produced by the concussion of a sledge hammer on an anvil. The anvil is surrounded by three houses parted by a 14-inch wall, and this heavy dead jar is very annoying to the neighbours. The only means we can suggest, is to place some soft substance, such as a sack of straw, between the floor or ground and the anvil; by this means both the noise and the vibration of the adjacent buildings will be very much diminished.*

A Subscriber *will find a full description of the Daguerre process in No. 43 (New Series) of the "Mechanic and Chemist."*

A Correspondent *has pointed out an omission in a former No. (32, N. S.), in which No. 97 of the "Century of Inventions" is wanting, and the number 97 placed at the head of No. 98. This typographical error has been overlooked, but we now rectify it by giving the omitted invention:—*97. "*An instrument whereby an ignorant person may take anything in perspective, as justly, and more than the skilfullest can do by his eye.*" *This is the invention alluded to in our remarks on the Daguerreotype, as having been so admirably accomplished by that magnificent discovery.*

H. W.—*Works on chemistry are now so numerous that we are at a loss to choose one in preference to the rest; but so rapid is the progress of that science, that the most recently published is likely to be the most correct. A small, but instructive volume has just been published, called "The Practical Chemist's Pocket Guide," by W. Hope, M. D., Glasgow. He will find some further account of this work in another column.*

S. K.—*The best material for razor strops is an oxide of iron, called by watch-makers "red stuff." Its degree of smoothness may be ascertained by its colour; the rough sort being almost black, and the smooth a bright red.*

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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HITCHING'S APPARATUS FOR PREVENTING ACCIDENTS TO SKAITERS.

VOL. V.—No. 25.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PREVENTION OF ACCIDENTS TO SKAITERS.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Having been an eyewitness to the loss of life upon the ice from the want of *immediate* assistance, I have been led to submit the following plan for insertion in your valuable Magazine.

A, a perforated ball of deal wood from 9 to 12 inches' diameter.

B, three stakes firmly fixed in the earth.

C, a coil of rope, one end attached to the ball, and the other end fastened to one of the stakes.

D, a boy immersed.

I would suggest, that the ball should be made of deal, and perforated, so that it might be grappled by the drowning person. To render the means applicable to persons *under* water, it would be advisable to have every alternate ball loaded, for the purpose of sinking them.

The advantage of the stakes would be to protect the coil from the pressure of the crowd; and they would also serve as a beacon.

I remain yours, &c.,
C. G. Hitchings.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 175.)

In my last lecture I described generally the use of the circulation, by enumerating a few of the important objects it performs; and after giving a brief account of the organs by which the blood is circulated in the lower order of animals, I partially completed a description of the heart, and the offices it is required to fulfil. I described its situation, the number of cavities it contains, with their uses, and a few particulars relating to its muscular structure. I have now to direct your attention to a portion of mechanism connected with this organ, which has ever been a subject of admiration to the student of Nature, and a powerful evidence in the hands of the theologian, of the existence, wisdom, and benevolence of God. I allude to the valves of the heart, which I before incidentally mentioned, when describing the manner in which the blood was acted upon by the different parts of that organ. The valves are for the purpose of causing the blood to proceed in one direction, by preventing its return to any of the chambers of the heart from which it may have been expelled. They are, therefore, placed in such a position, that while they offer no impediment to the entrance of the blood into the auricle or ventricle, they effectually prevent its returning back; and they act on a principle so purely mechanical, and so easily to be understood, that any one who has taken the trouble to examine a sheep's heart, for instance, will never forget the beautiful instance it affords of the application of an admirably simple contrivance, to a purpose of permanent importance. If we cut a heart across in order to examine it, we shall find, on attempting to pass any substance upwards, that its progress will be resisted, and if a portion of the muscular part be taken off, so as to exhibit the obstruction, the valves and their use will then become evident: they will be seen to be somewhat in form like the sails of a ship, one edge being fixed to the side of the heart, and the others tied down, as it were, by little cords: the use of which I shall explain more at length presently. When the blood attempts to pass back, it gets between the sides of the heart and these valves, and bulges them out, so that they press against each other, and close the passage as completely as if a single membrane had been drawn across the opening. In the great artery which rises direct from the heart, the aorta, the valves are of a different form, though performing the same office. They are there like three little cups fixed to the side, which being very flexible, are easily pressed against the side of the vessel when the blood is passing out of the heart; but if it attempts to return, it then fills these cups, which are, consequently, pressed out, stop up the artery, and so prevent any further retrograde motion. The three cups being nearly round, there is, of course, a small opening between them, where they touch each other; and the contrivance by which this opening is closed, is another evidence of the perfection of this mechanism. Each valve, or cup, as I have called them, is furnished with a little projecting tongue, which, when the valves are distended, just fill up the opening that would otherwise be left. Nor are these the only instances of beautiful mechanism endowed with the property of life, to be found in this structure. There is something even yet more surprising; and in describing it, I cannot do better than use the words of the writer of the very excellent treatise on animal physiology in the "Library of Useful Knowledge." He says, "There is a further contrivance adopted, and one which the mind cannot contemplate without admiration, in order to render the action of

the valve placed between the auricle and ventricle perfect. Were the membrane, which is placed in this situation, loose, it is obvious that the refluent blood would carry it back into the auricle, and thus effectually prevent its action as a valve. But the fleshy columns which are placed in the inside of the ventricle, give off numerous threads, which are attached by one extremity to these fleshy columns, and by the other to the loose edge of the valve. These tendinous threads, like so many strings, tie down the valve to its proper situation; and being thus secured, the membrane is not only prevented from being carried by the impetus of the refluent blood too far into the auricle, but that any impetus is the means of giving it the distension and figure that are required. But the perfection and beauty of the mechanism do not stop even here. Each of these fleshy columns may be considered as a distinct muscle; each is endowed with the peculiar property of the muscular fibre, that of contractility; each is excited to contraction by the contact of the blood, just as the ventricle itself; each, therefore, by contraction, shortens all the tendinous threads attached to it, just at the moment that these strings require to be tightened; and they further tighten them in the precise proportion required; for the distension of the membrane by the refluent blood stretches these tendinous threads, and the stretching of the tendinous threads stretches the fleshy columns. The fleshy columns are thus still further irritated, excited, stimulated: the consequence of this excitation is proportionably increased contraction, and the ultimate result, increased security that the valve will be held in the precise position that is required, with exactly the degree of strength that is wanted. Thus there is accomplished here the construction of a valve, which is not only most perfect in itself, but which is endured with a property to which no other mechanism affords any parallel—a valve capable of generating a power that enables it to act with additional force, whenever additional force is requisite. Among the countless instances of wise and beneficent adjustment familiar to the student of nature, there is commonly some one upon which his mind rests with peculiar satisfaction; some one to which it finds itself constantly recurring, as affording the proof which cannot be resisted, of the operation of an intelligence that has foreseen and planned an end, and provided for its accomplishment by the most perfect means; and surely there is nothing more worthy to become one such resting place to the philosophic mind, than the structure and action of the valves of the heart."

If anything further could be added to this beautiful description, in confirmation of the passage with which it concludes, it would be from a consideration of what would be the effect of the valves not efficiently performing their office. They are formed of the most delicate material; so thin, that it is almost transparent; and they are tied down, as just mentioned, by tendinous threads not thicker than sewing silk. Yet with this appearance of weakness, they possess a strength that is most extraordinary. They cannot be torn from the heart without great violence, and to this circumstance we owe the daily enjoyment of life and health. Had they been liable to the derangement we might at first sight imagine they could not fail of being constantly subject to, what a life of misery would ours have been! They are sometimes attacked with a disorder, in consequence of which they lose their elasticity, and become converted into bone; and the sufferings of the unhappy patient in such cases show what the value of their regular action is in general, and how well they perform their duties for the number of years they are so actively employed.

It may naturally be supposed, that an organ of such great importance as the heart, is protected from all kind of injury as far as possible; and its situation in the breast, where the hands can be brought to protect it with the greatest ease and convenience, is an example how far this object has been accomplished externally. But in addition to this, and the protection it receives from the bones with which it is surrounded, it is carefully covered up in a case, called the heart's sac or Pericardium, which adheres to its external surface, supports it in its situation, prevents its action being interfered with by other organs, and supplies a fluid to keep its surface moist, and facilitate its motion. This fluid accumulates after death, and a grave discussion once took place among the older anatomists whether this was not the fluid which came from the side of our Saviour when it was pierced with the spear! Though this might probably be the case, it was hardly a fit subject for angry discussion. The heart's sac is very strong, and affords great support as well as protection to that organ. Though rough on the exterior, it is beautifully smooth within, so that it affords the most perfect facility of action; and considered merely with reference to the properties I have described, without referring to the vital actions it may perform, or assist in per-

forming, it is a beautiful example of the perfection of the heart's mechanism. For after everything has been done to render it perfect, it is enclosed *in a case* to protect it from injury, just in the same way as an artizan would guard any work of mechanism on which he had bestowed his best care and attention to bring to perfection.

I have thus given you a general description of the structure and use of the heart, the powerful organ by which the blood is circulated; I have now to call your attention to the vessels or tubes through which the blood is conveyed. These are of two kinds; one proceeding *from* the heart, and called *arteries*, the other coming *to* the heart, and called *veins*.

The *arteries* are the vessels which contain the purified blood, and convey it from the heart to every part of the body. They commence in one large trunk called the aorta, which rises direct from the left ventricle, and subdivides into an innumerable number of branches, and they become gradually smaller as their distance from the heart increases. The arteries are formed of three distinct coats, each of which has some property peculiar to itself. The outer coat, the case for the other two, is very tough and elastic, and gives the artery a great degree of strength, for which reason it is found to be much thicker in the larger arteries than in the small ones, as the former have to bear a pressure and force of the blood from which the smaller vessels are relieved. The second or middle coat is muscular, and it possesses the same property as the heart itself of contracting. It consists of a number of rings; or, more strictly speaking, of *half rings*, which meet, and so form circles round the artery. Having the property of contracting, this coat of the vessel greatly assists the power of the heart in moving the blood; as it is evident when the rings contract they must squeeze their contents onwards, and thus force the blood in the direction required. It is a singular fact, that this coat is found much stronger in comparison in the small arteries than in the large ones. In the former the heart's action cannot be felt so powerfully as in the main trunks of the vessels; and hence it is necessary that they should be better provided with the means of assisting the circulation. At the same time the outer coat is much thinner, because strength is not so greatly required. The third and inner coat of these vessels is evidently formed for the purpose of affording the greatest facility to the passage of the blood. It is so beautifully smooth that I am at a loss for a simile. A tube of metal, with the highest polish the interior could receive, would not offer so little resistance to the passage of a liquid: for in addition to its exquisite smoothness, the interior of the artery secrets a peculiar fluid, which serves still further to remove all possible friction, and facilitate to the utmost the motion of the blood; and this is also promoted by the action of the muscular coat.

(*To be continued.*)

LOAN SOCIETIES.

To the Editor of the Mechanic and Chemist.

Sir,—Although the following statement may not relate to a subject usually treated in your valuable work, I do consider from your wish to protect the public from imposition, you will give it a place in your columns. I have, Sir, unfortunately been induced to accept a loan from a Society called the Eagle, in Long Acre, which I consider you will find fraught with evil to the poor man, and who, I should like to know but the poor would require their aid? Now, Sir, to enter into detail, you first pay 2*d.* for a copy of rules, then 3s. (the stated average is 2*s*) for looking after security; mine happened to be a few yards over two miles, which gave them a pretext for charging another shilling. The interest at 5 per cent, with price of book 1s. is deducted previously to the loan being placed into the hands of the borrower, which leaves a nett of 4*l.* 10*s.* 10*d.* out of 5*l.* He has then to pay by instalments 2*s.* per week and 2*d.* for booking; if missing, 1*d.* fine each week omitted, and if the second week be left, the secretary sends a circular, in which he demands 6*d.* fees, 3*d.* fines and 3*d.* for letter, amounting with postage to 1*s.* 2*d.*, which he may demand the moment the two weeks are expired. From various reasons I have been obliged to pay two weeks when three have been demanded, they have then charged the whole of the fines, and if let run on another two weeks, charged for three weeks.

Then, Sir, if a person go previous to the time for payment, which is on Wednesday evening, and have no letter sent, they charge the 3*d.* the same, and if he murmur, they say, "Oh, if you do not like that I will send as soon as the two weeks are expired. I have now reimbursed 2*l.* 8*s.* of sum lent, for which I have actually paid 17*s.* 6*d.*!!!

Your obedient Servant,

W. M'C.

P.S. That they may know who writes this, my number in their books is 779.

[The above letter was accompanied with

testimonials of the truth of the allegations it contains, and we can affirm that the writer is an honourable and respectable person; we therefore not only feel authorized to publish it, but consider it our incumbent duty to do so. We do not point out this particular society as worse than their numerous rivals, but merely take it as a fair average of the extortionate Loan Societies of London. As we have no knowledge of the parties who divide the spoils of the victims who writhe beneath the talons of this ruthless "Eagle," we trust that our sincerity will not be questioned, when we declare that in analizing the rules of this Society, we are influenced by no other motive than a desire to lead the unfortunate and the inconsiderate from so dangerous a path, and make them sensible of the ruin which lurks beneath the specious and alluring professions of heartless, usurous, and overreaching speculators. First, let us inquire what is the rate of interest per annum exacted from the borr ower under the most favourable circumstances, and supposing the Society to refrain from all further extortions, which, we shall afterwards show, are indefinitely sanctioned by their printed laws. In order to obtain this "benefit," the borrower of 5*l.* must find respectable bail within two miles of Long Acre, (the centre of the Society's web), and that bail must be accepted by the Society, otherwise they will make additional charges for further inquiries; he must also punctually pay his instalments at the exact periods appointed, under the penalty of considerable and vexatious fines. Under these circumstances, the borrower must pay 2*s.* at the time of application, and in addition to that sum 5*s.* is deducted for interest, which, according to the Society's computation, is 5 per cent, and 1*s.* for a half-penny book, leaving 4*l* 12*s.* the sum actually lent. For this accommodation, the borrower is required to pay 2*s.* 2*d.* per week for fifty weeks, making together 5*l.* 8*s.* 4*d.*, from which it appears that the money lent, is repaid within a small fraction on the forty-fifth week. But the value of the interest on each successive portion of the capital repaid by weekly instalments, forms an arithmetical series; therefore this mode of payment is equivalent to the whole being paid about the twenty-third week, or $\frac{23}{52}$ of a year, now the interest demanded for the loan of 4*l.* 12*s.* for that period, is 16*s.* 4*d.*, consequently $\frac{23}{52}$ annual interest = 16*s.* 4*d.* and annual interest = 1*l.* 16*s.* = 39 per cent. On this statement we have omitted fractions, and have mostly given the benefit of them to the vulture—we beg pardon, the "Eagle" Society. Now if we add to this amount the produce of the various casualties, snares, and impositions from which very few, or perhaps none can wholly escape, the interest will amount to about double the above already scandalous extortion. We must, however, give this Society credit for some clever contrivance which enable them to regulate their demands according to the different degrees of resistance opposed by different dupes; we will quote as an example, a beautiful passage in the fourth Article of the rules: —"Each borrower will also have to pay such further sum *as may be agreed upon between the Directors and him* towards defraying the necessary expenses of books, printing, management, and rent of office; as also for a fund for the liquidation of any losses which may be sustained by death or otherwise; part of which sums may be paid at the time the Loan is advanced, and the remainder by weekly payments with the other instalments." We conclude for the present this very unpleasant, but we trust, not useless investigation, by imploring those of our readers who may unfortunately be in want of Five Pounds, to avoid Loan Societies of this description, whatever difficulties they may encounter, or whatever privations they may endure.—Ed.]

IMPROVED METHOD OF TEACHING MUSIC.

It has often been remarked and wondered at that music should be so little understood, and so imperfectly taught, as it is in most countries, and more especially in England, notwithstanding the almost universal desire, if not to cultivate it as a science, at least to practice it as an art. We do not require the practical musician to dive into profound calculations concerning harmonics (one of the most difficult branches of the mathematics), nor do we recommend that the practical progress of the amateur student should be impeded by a premature inculcation of the principles of harmony and rhythmic erudition; but such is the incapacity of many who undertake the office of teacher, that they are not only ignorant of everything beyond mere notation and mechanical performance on some instrument, but are actually incapable of reading and understanding a piece of music without instrumental aid. About eight or ten years ago, a schoolmaster at Zurich imagined a system of teaching, which succeeded so

well, that he was induced to visit all the principal towns in Switzerland, for the purpose of explaining and establishing his plan of instruction; he was invariably received in the most flattering manner, and his system carried into operation. His lessons were confined to sacred music, and he was usually allowed the use of a church. A large black board, with five conspicuous white lines for the staves, was exhibited in a convenient place, so that everyone present might see it. On this board (which he calls *ardoise* or slate) the notes were written with chalk, and altered according to the subject of the lecture or lesson. The teacher holds a wand with a white ball at the end, and with this he points out the note to be sung, passing promiscuously from one part of the scale to another, till the pupils are able to produce the proper intonation, and sing any simple melody at sight. This is a great point gained, and should, we conceive, always be the first step in the study of practical music. Other subjects are successively treated in a similar manner, till the pupil has attained the required proficiency. This plan has since been introduced in France, and we hope to see it in operation with equal success in England. The following is extracted from a correspondent of the *Athenæum*, dated "Paris, Jan. 18."

"Without examining how far popular opinion may or may not have of late unjustly connected the merits of M. Mainzer's method of instruction with the little honour awarded to him as a composer—his opera 'La Jacquerie,' upon its recent production at the Theatre de la Renaissance, having, on account of its want of variety, been sarcastically characterized in the *feuilleton* of M. Berlioz as 'an opera in *re*' (the key of D)—it is certain, that M. Wilhem's plan has been adopted in schools of a high order, as well as among the public of the markets and boulevards—that it has been circulated over the continent, is now in England, having been recently taken thither by some professors, who intend introducing it in London. Hence it is needless for me, were I qualified, here to discuss it analytically—I am still less able to furnish a connected sketch of the whole process; but a leaf from my journal, in which is chronicled my Saturday evening's occupation, may afford some far-off idea of one of its best features—namely, its providing adequate and simultaneous interest and occupation for scholars of every degree, from the urchin, on his first evening's entrance from the *quay*, or alley, progressively upward to the well-practised monitor, so firm in scientific knowledge, that he is able not only to read, at sight, a single *solfeggio* from Steffani, Durante, and Handel, of any intricacy, but also to maintain his own part in proper style and spirit, however complicated be the whole, of which that part is only a third or a fourth.

I was present at the drilling of a class of men, of all ages, and, it seemed, of all conditions. When the moment for commencement arrived, the entire party was separated into twenty or thirty smaller companies, each numbering some fifteen or twenty individuals—each, too, under the guidance of a monitor, who referred to an exercise board in aid of his explanations. Thus arranged, they extended round the room, leaving its centre free for the superintendent, who, baton and tuning-fork in hand, presided over their exercises. Nearest the door were the new-comers, to whom their monitor was explaining the number of notes in the scale, and their names, '*Do, ré, mi*,' &c.,—availing himself, at the same time, of an ingenious *memoria technica*, which is one of the peculiar inventions of M. Wilhem's system, and in which the fingers, and the spaces between them, are employed by the neophyte to represent to himself the octave and its divisions. The next knot consisted of those who, having learned their notes, were reading *verbally*, not *vocally*, a scale-exercise, in which some of the simplest divisions of rhythm and tune were inculcated. A third group was studying the first intervals—the hand alphabet which I have mentioned being employed by all, and every pupil being compelled to read and count his exercise ere he attempt to sing it;—while a fourth party was taking in fifths, sevenths, ninths, &c.; and so on, until those were progressively reached who were firm and ready enough to attack a composition in two or more parts. It was so arranged, that while one section of the pupils was singing, others might continue their *reading* practice undisturbed; and, from a careful inspection of the whole, resulted the impression, that no element of music was overlooked, or its comprehension empirically forced upon the pupil before he was prepared for its reception. I ought to add, that the exercises commenced and closed by the whole body singing the scale together: first, the notes of the common chord—then the tones and semi-tones of the octave, ascending and descending, *pianissimo* and *fortissimo*—now detached, now bound—then in thirds—lastly, in a full harmony, of three parts. The effect of

this, from the purity, firmness, and sweetness of the tone, was very fine.

If I were musicially pleased with the results of a system so comprehensive in its operation, I was no less morally gratified by the diligence and respectable demeanour of the learners. The mature man of forty (and there were many such in the company) was not more sedulous or attentive than the *gamin* of twelve, with his longer life of a tenor or bass voice before him. There was no rude joking—no making a pretext of the presence of strangers as inquisitive as ——— and myself, for carelessness or want of application. All seemed interested, because amused, by that healthiest of all amusements, the reception of new ideas, upon a subject in itself welcome and agreeable. I must insist, moreover, that M. Wilhem's method, here carried into effect by his able pupil, M. Hubert, seems excellent, as inculcating, from the first, some principles of style as well as of science. Of this I had confirmatory proof in the exercises gone through by the monitors after their pupils were dismissed. These young men first read, and afterwards sang, *solfeggi* of great complication and difficulty, at first in single parts, then in combination; and this not merely with a mechanical firmness, which no syncopation, or protracted division, or difficult interval, or accidental sharp or flat, could shake; but with a feeling for that expression and regulation of phrase, which, when in perfection, almost as much as physical attainment, distinguishes a Thalberg or a Mendelssohn from the well-trained child, who makes impartial friends yawn with her *pianism* at holiday-tide! In short, all that I saw and heard satisfied me highly at the moment—satisfies me yet more completely on reflection."

MISCELLANEA.

To make Turpentine Varnish.—Take one gallon of spirits of turpentine, and five pounds of rosin pounded; put it into a tin can on a stove, and let it boil half an hour; when cool it is fit for use.

To make the Best White Hard Varnish.—Rectified spirits of wine, two gallons; gum sandrach, five pounds; gum mastich, one pound; gum anime, four ounces. Put these in a clean can or bottle to dissolve, in a warm place, frequently shaking it; when the gum is dissolved, strain it through a lawn sieve, and it is fit for use.

W. G. A. H.

Goldbeaters, by hammering, can reduce gold to leaves so thin, that 282,000 must be laid upon each other to produce the thickness of an inch, yet those leaves are perfect, or without holes, so that one of them laid upon any surface, as in gilding, gives the appearance of solid gold. They are so thin, that if formed into a book, 1500 would only occupy the space of a single leaf of common paper, and an octavo volume of an inch thick, would have as many pages as the books of a well-stocked library of 1500 volumes, with 400 pages each.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street.—Thursday, Feb. 6, J. C. Bowles, Esq., on Hydrostatics. At half-past eight.

Poplar Institution, East India-road.—Tuesday, Feb. 4, W. Jones, Esq., F. R. C. S., on Vital Statistics. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney-road.—Tuesday, Feb. 4, W. A. Sherwin, Esq., on Mining. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross-street.—Monday, Feb. 3, J. T. Strange, Esq., on Magnetism and Electro-Magnetism. At half-past eight precisely.

QUERIES.

What is British silver composed of, and the various portions of each substances contained therein? T. F. B.

I have in my possession an old home-made violin, which is very dirty; I wish to clean, stain, and polish it, but know not how to proceed; if you or any of your correspondents will favour me with a method for so doing, it will much oblige A. C. R.

1. What will remove the silver from plated goods without injuring the silver? I have tried the following, but it did not answer:—To 3lb. of sulphuric acid, and 1½ oz. of nitre, add 1 pint of water; boil the goods in it, then put the silver into common salt, dissolved in water. 2. What is the best way to dissolve India-rubber, so that when dissolved it may be applied to render paper water-proof? 3. Is there any substance into which Congreve matches may be dipped, that will restore their igniting quality which they have lost from being kept too long? A. R. S.

1. How to make fulminating silver (giving the whole process)? 2. How the crackers which you throw down, and those you pull, are made? 3. How to make printing ink? 4. How to make good amalgum? 5. How to make a mould of plaster of Paris which last for several times? 6. Whether fulminating mercury will make as loud a report as silver? R. H. H.

1. Has any one in Brighton, or its immediate vicinity, a good electrical magazine to dispose of at a moderate price? 2. How to construct a working model of a velocipede? 3. How to imitate rock-work for models of rims, &c.? 4 The most economical method of making a galvanic battery? Also, what experiments can be performed with it? 5. The manner of making a reflector, so as to throw the reflection of a light in any direction? Melek Ric.

I should be greatly obliged if any of your correspondents could inform me where I can purchase a book on short-hand writing cheap?

A Young.

How to prepare liquid sulphuretted hydrogen?

Erasmus the Elder.

1. How is the exact precision of thermometer tubes throughout their length, to be ascertained? 2. Does the bitter of coffee possess a strengthening quality? 3. What is the best means of preserving geraniums during winter? 4. How are percussion caps manufactured? 5. What are the principal causes of variation in the carrying distance of different guns? 6. Can any of your correspondents describe the air gun? 7. What is the best substance to execute models in, similar to that of the rock of Gibraltar in the long room at Woolwich? 8. What distance will a thirty-two pounder carry, if the ball meet with no interruption until it be quite spent?

Wm. V——e.

ANSWERS TO QUERIES.

A correspondent wishes to know the cheapest means of constructing a hydro-oxygen microscope. The best way, I think, is to buy one already made, if cheapness be his object. I have one (equal to any ever made), with objects, &c., which I wish to dispose of. C. S.

5, Garden row, High street, Camberwell.

☞ *To prepare an Ink for Printing on Linen with Type.*—"P. Y. H. U." Dissolve one part of asphaltum in four parts of oil of turpentine, and add lamp black, or black lead, in fine powder, in sufficient quantity to render the ink of proper consistence for printing with type.

Erasmus the Elder.

To Varnish and Colour Violins Yellow.—Take half a gallon of rectified spirits of wine, to which put six ounces of gum sandrach, three ounces of gum mastich, and half a pint of turpentine varnish; put the above in a tin can, keep it in a very warm place, frequently shaking it, until it is dissolved; strain it and keep it for use. Should you find it harder than you wish, you may add a little more turpentine varnish. There is no need whatever to stain the wood, as a very small bit of aloes put into the varnish, will make it of a good colour, and has the desired effect.

☞ *To make Phosphoretted Hydrogen.*—The easiest and cheapest way to make this gas, so that it may be experimented on, is by placing one part of phosphorus, and ten parts of strong solution of potash, in a common oil flask, with a cork in its neck, to which is attached a glass tube, properly bent, the bottom of the tube dipping into some water; bring the mixture into the flask to boil, and an abundance of this gas will be extricated, and inflame at the top of the water. But I think the following will suit your correspondent's views still better. Take a tumbler, and place in it half a part of phosphorus, cut in very small pieces; 1 part of granulated zinc; 3 parts of concentrated sulphuric acid; and 5 parts of water; sulphuretted hydrogen is obtained, and the whole resembles a well of fire. If your correspondent requires any further explanation, I shall be most happy to supply him with it. R. T.

TO CORRESPONDENTS.

An Apprentice.—*We refer him to our publisher, Mr. Berger, in Holywell-street, where he will obtain the information he requires.*

Mebe Ric.—*To find the diameter of a circle seven times greater than a given circle, take the square root of seven times the square of the given circle.*

The distances, and consequently the sizes of the planets may be computed by their parallax, which is, in fact, only a particular application of trigonometry.

Various attempts have been made to improve, condense, and simplify the Elements of Euclid; but in our estimation, the original work is, beyond comparison, superior to all those which are intended to supersede it.

There is a description of a cheap air-pump in No. 47, Vol. 2, of the "Mechanic"; we think, however, that some of our correspondents might favour us with a more convenient construction.

The best cement for uniting brass-work with glass, is shellac applied by heating the parts to be joined, when the nature of the apparatus will allow it, but if not, it may be dissolved in spirit, and a small quantity of isinglass (ichthyocolla) added to make it less brittle. This composition will also serve to render wood or paper waterproof.

William V——e.—*The undulations of the air, which are the cause of sound, are usually compared to the circles formed in water when a stone is thrown into a still pond; there is, however, this material difference, that the vibrations of sound are propagated in spherical shells expanding in every direction, as the undulations of water expand horizontally. But although air is the vehicle by which the vibrations of sound are ordinarily conveyed to the ear, it must be observed that other substances possess the power of transmitting those vibrations, even with more intensity than the air, as may easily be shown by placing a watch at one end of a long piece of timber, and applying the ear to the other end, when the ticking will be distinctly audible. When a vibrating sonorous body is enclosed, as we find in a musical snuff-box, the direct series of vibrations communicated to the air by the sonorous body, do not reach the ear, there being no communication between the internal and external air; but the box itself vibrates, and the sound is accordingly found to vary in quality and intensity, with boxes composed of materials possessing different sonorous powers; also the aptness for vibration of the table on which the box is placed, very considerably affects both the intensity and the timbre or voice of the sounds. The vibrations of a bell placed under the receiver of an air-pump, are not audible, there being no medium of communication between the vibrating body and the substance of the machine or the receiver.*

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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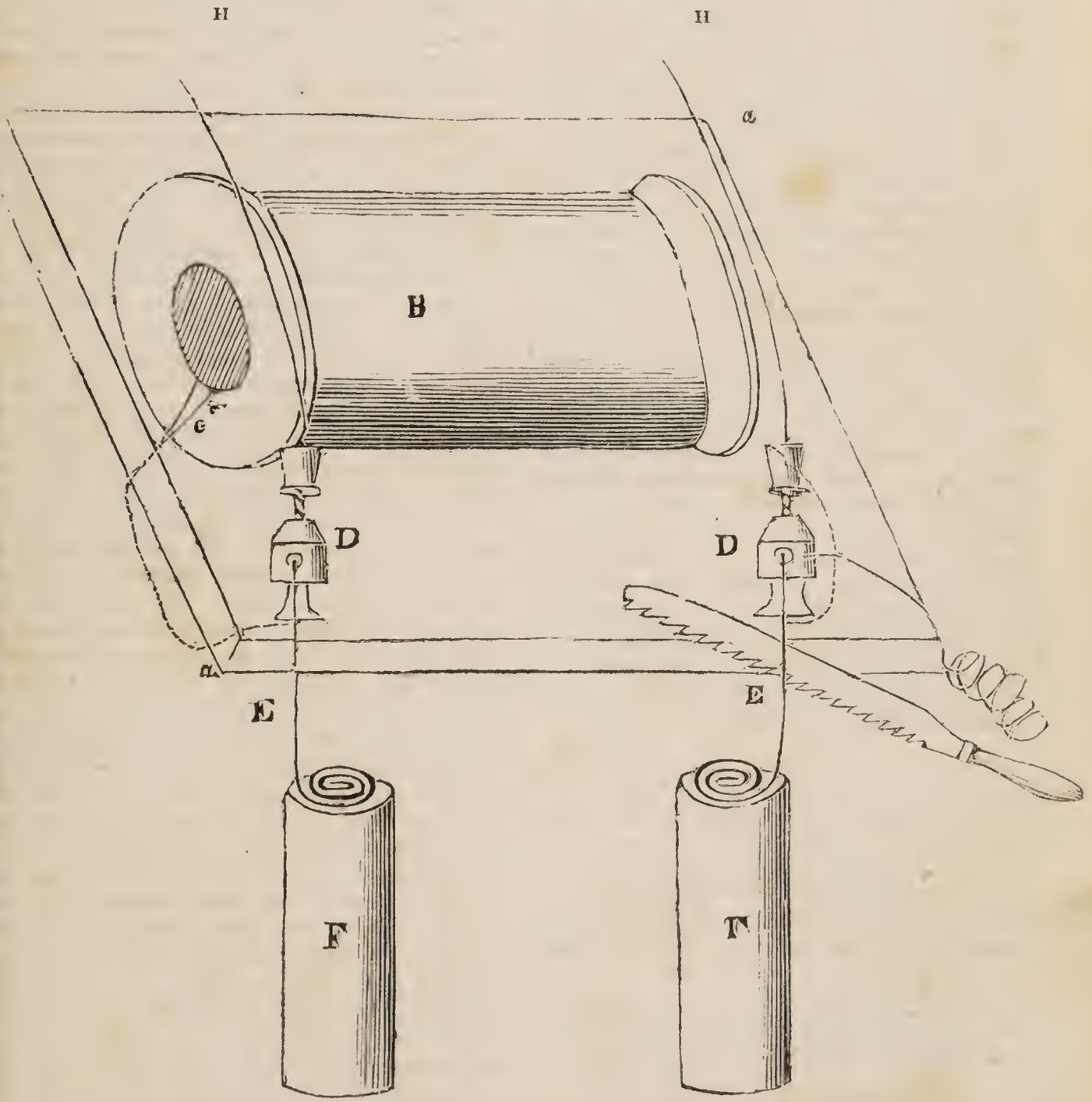
ELECTRO-MAGNETIC MACHINE.



VOL. V.—No. 26.]

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

ELECTRO-MAGNETIC MACHINE.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—"Magneticon" will perhaps find the following electro magnetic machine answer his purpose. I have not seen any other kind, of the same size and number of batteries, more powerful.

a a a a is a square board; B is a round spawl, with a hole through it, one inch in diameter, with a flange about three inches; it is four inches long. Through the flange there is a small hole bored, to fasten it to the board, and another, *c*, through which the ends of the copper wires are placed. The copper wire which is first wound round, is about the sixteenth of an inch thick; of this wind but one thickness, and then about 700 feet of the finest wire (I believe) which is covered; both ends of these wires must then be soldered together, and brought underneath the board and soldered to the screw, by which the brass connector, D, is fastened to the board. The connector is made of brass, with a hole through the side, into which the set screw pushes, with a hollow top, to contain a small portion of mercury; through these holes are placed the copper wires. E E, to the end of which (after it has been bent into a spiral spring, so as to allow it to give way) is soldered a brass tube, F F, to take hold of; into the cups are then placed the wires, H H, from the batteries, the connectors of which are made in the same way: G is a small brass saw for breaking the connexion, instead of the revolving magnet; it is connected to the mucrid cups by a small spiral wire. The ram to be placed in the spawl is a cylinder of sheet tin, which is filled with pieces of soft iron wire.

W. E.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 186.)

THE arteries are distinguished from the veins by having what is termed a pulse.* In the veins the motion of the blood is not perceptible; but in the arteries, it is felt bounding up against the sides, in the way you may perceive, by looking at the part between your thumb and finger, where you will see a small artery continually beating. If one of these vessels be cut—if it be a large vessel—the whole of the blood in the body will soon be forced through the wound, and the animal will die. Indeed a slight incision in any of the larger arteries, is sufficient to cause death from loss of blood; and in this way literally "each of us may his quietus make with a bare bodkin." The arteries are, in consequence, provided against accidents as much as possible. They do not lie so near the skin as the veins; indeed the latter, when the hand is warm, seem almost starting from the skin; but the arteries are situated deeper in the flesh. They are well protected from injuries occurring from the force of the blood by the strength of their coats; but these are not always sufficient for the purpose. They are sometimes injured by the centre coat, which, as before mentioned, is muscular, breaking and allowing the blood to distend the other coat. Whenever this occurs, a singular and terrible disease takes place, which is called aneurism. The outer coat is so strong and elastic, that it will not break like the muscular coat, which is found to be exceedingly brittle; but, unable to resist the force of the blood, it gradually becomes distended into a sac, which bulges out from the side of the artery, and which, if it bursts, allows the whole of the blood to escape. It is not necessary that I should detail to you farther particulars of this singular accident to which the arteries are subject. I need only mention, that while in former days it was considered fatal—as the means by which the accident could be remedied were unknown—it is now cured every day in our hospitals, when it occurs in arteries even but a small distance from the heart, by stopping the passage of the blood in the affected vessel, and thus preventing the blood passing the part diseased. It is found that little inconvenience is experienced from this stoppage of the artery, though we might at first suppose that mortification would ensue; but these vessels communicate by branches so freely with each other, that when one artery is stopped up, another performs its duties.†

* The following is a table of the rate at which the pulse usually beats at different periods of life, and likewise in some of the domestic animals:—

	Per Minute.
In infancy, from	130 to 140
Middle age	72 to 75
Old age	60 to 65
Horse	32 to 38
Ass	48 to 54
Ox	35 to 42
Sheep	70 to 79
Goat	72 to 76
Dog	90 to 100
Cat	110 to 120.

† In lecturing to ladies, and, indeed, to general audiences on physiology, it is desirable not to

The importance of these vessels is seen by the care with which they have been protected against external injuries. Had they been exposed, like the veins, the most trifling accident might have been fatal, whereas, by being deeply seated, they are comparatively out of danger. But this is not the only way in which they are protected: in exposed situations they have channels formed for them even in the bones. Thus, under each of the ribs there is a perfect channel in order to protect the arteries passing along them; and in the spine, the head, and many other bones, there are holes formed purposely to allow the branch of an artery to pass through without being injured by any improper degree of pressure or otherwise. Paley expressly alludes to the care which has been bestowed on the protection of the arteries, as an instance of divine Providence. "Forasmuch," he says, "as in the arteries, by reason of the greater force with which the blood is urged along

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introduce any subject that may occasion groundless fears, or give any support to the assertion, that a knowledge of the subject by non-professional persons leads to hypochondriacism. I carefully avoided, therefore, noticing more at length, the subject of aneurism, which it was, indeed, unnecessary to say anything particular about. To give the reader, however, some idea of the nature of this afflicting disorder, I have thought it would not be uninteresting to quote the following graphic description from John Bell, of aneurism of the aorta, the largest artery of the body, and which, of course, cannot be stopped like any smaller one. "Among the diseases of the heart," he says, "we may reckon the dilatation of the aorta, a disease more frequent than all the others, and more dreadful. It is a disease more frequent in the decline of life; it is then a disease of weakness. It arises from a cause quite different to that commonly laid down. The celebrated Dr. Hunter believed that it arises from that predisposition, or weakness, which naturally belongs to the form of this part, viz., a sudden angle of the artery, exposed in the most direct manner to the whole force of the heart. Dr. Hunter also believed, that no sooner is nature aware of this danger, than she seeks to prop up the artery, and for this end thickens its walls, till it ossifies (becomes bone) by slow degrees. Hallier's theory comes nearer the truth, for he makes these scales of ossification not the consequence, but the cause of the disease. He says, 'The artery becoming scaly, and partly ossified, no longer yields to the force of the heart; and the heart thus excited to a higher action, is itself dilated, and at last forces also the aorta. In truth, neither of these theories is true; but the aorta in aged persons beginning to ossify, has its middle, or muscular coat, annihilated, and its outer and inner coats, thickened by the same process. Its muscular power is lost; it is no longer capable of withstanding, much less of seconding, the action of the heart. It ceases to act, suffers itself to be dilated, and in a few years grows into a dreadful disease. I never saw an old aorta wanting some specks of ossification, or rather of calcareous concretion; nor an aorta so affected, which was not dilated in proportion pretty nearly to the degree of this thickening and ossification; at which we need not wonder, since we find not a bone (as it is usually called ossified aorta) but a vile calcareous concretion substituted for its muscular coat. Nature is not at this time, as Hunter supposed, building up and strengthening the walls of the aorta against this disease, but taking down slowly that fabric which has lasted its appointed time. However it is produced, it is an awful disease; for every organ, when once deranged, especially if it be one as active as this is, never stops in its course, and this especially ends, early or late, in some terrible kind of death Sometimes, increasing in size, it destroys all the surrounding parts, and bursts within. Sometimes it bursts into the chest, and then the patient drops suddenly down; sometimes into the trachea (windpipe) and then the cause of the sudden death is known, for the patient, after violent coughing and ejection of blood by the mouth, expires. Sometimes it beats its way through the ribs, destroys the vertebræ, affects the spinal marrow, and thus the patient dies a less violent and sudden death. Oftenest of all, the tumour rises towards the root of the neck, is felt beating there, destroys the breast bone, bursts up the ribs, dislocates and throws aside the clavicles (collar bones) appears at last in the form of a great tumour upon the breast, beating awfully. A dreadful state! and with nothing to keep in the blood but a thin covering of livid skin, which grows continually thinner, till, bursting at last, the patient expires in one gush of blood. But nature seldom can bear all this distress; the patient dies before this awful scene commences; for the aorta often so fills the chest, so oppresses the lungs, chokes the trachea, and curbs the course of the descending blood, that the system with a poor circulation of all oxydated blood, is quite exhausted. And thus, though the patient is saved from the most terrible scene of all, he suffers great miseries: he feels sharp pains passing across his chest, which he compares with the stabbing of knives and swords; terrible palpitations; often an awful sense of sinking within him; the sound within his breast as if of rushing waters; *a continual sense of his condition;* sudden startings during the night, and fearful dreams and dangers of suffocation; until with sleepless nights, and miserable thoughts by day, and the gradually failing of an ill-supported system, he grows weak, dropsical, and expires." Happily for humanity, these affections are not of frequent occurrence. The imagination of the greatest novelist could not conceive a death more awful; and with whatever kind of death Dickens may intend to close the career of old Ralph Nickleby, he will not portray one more appropriate and more horrible than this. The rarity of such disorders shows how well and how effectually the mechanism of our bodies has been contrived, and how perfectly it performs its duties unceasingly for years.

them, a wound or rupture would be more dangerous than in the veins; these vessels are defended from injury, not only by their texture, but by their situation, and by every advantage of situation that can be given to them. They are buried in sinuses (as in the head) or they creep along grooves made for them in the bones (as in the ribs). Sometimes they proceed in channels, protected by stout parapets on each side, which last description is remarkable in the bones of the fingers, these being hollowed out on the under side, like a scoop, and with such a concavity, that the finger may be cut across to the bone without bursting the artery which runs along it at other times. The arteries pass in canals wrought in the substance, and in the very middle of the substance of the bone. This takes place in the lower jaw; and is found where there would otherwise be danger of compression by sudden curvature." An equal degree of protection is extended to the arteries in passing over joints, where it is evident, unless great care had been bestowed, they would continually be in danger of being twisted, and otherwise injured, from the movements of the limbs. The cause of the superiority of the right arm over the left in regard to strength, is in consequence of the former receiving a greater supply of blood than the latter. It is well known that the right arm is invariably the strongest, and in general this is supposed to be in consequence of use. But whatever influence this may have, there is a physiological advantage possessed by the right arm, which of itself is sufficient to account for the difference. The artery which supplies it with blood, goes off from the aorta more directly, and is larger than that which supplies the left arm; the latter consequently receives a less quantity of blood, the vital stimulus is less, and it is weaker. Bell says, "That, independent of the effect which use may have in strengthening the right arm, it is the peculiar form or direction of its artery which gives it its superior dexterity and strength. When horses are to be broken, we find the chief difficulty to consist in teaching them to move equally with both feet, for they prefer the right. When a dog trots, or when he digs the ground, he goes with his right side foremost, and digs chiefly with his right foot; and in these creatures we find the same arrangement of the arteries as in ourselves. When we lose our arm, the left hand acquires by use all the strength and dexterity of the right. Since, then, either arm can acquire this dexterity, and since the right leg is stronger by its dependence upon the motions of the right hand, we have every reason to believe, that the preference given to the right hand has some physical cause, and that it is the peculiar form of its artery in going off more directly on the right side. In birds, whose wings are of equal strength, the arteries which supply them with blood are sent off from the aorta direct on each side, and they are also equal in size and form; so that one wing receives exactly the same quality and quantity of blood as the other.

(To be continued.)

EFFECTS OF THE ATMOSPHERE AND ELECTRICITY ON THE HUMAN BODY.

(From Dr. Sigmond's Treatise on the Use of Mercury.)

The older physicians laid particular stress upon the influence of the sun and moon upon human bodies; and Dr. Mead has collected some very curious instances to prove the influence of the planets. Modern science and experience have shown, that although the paroxysms and periods of disease are guided by regular laws, there is no reason for the belief that the celestial bodies are in any way connected with them, but that they are dependent on atmospheric changes. We find, under particular aerial states, that epidemics are prevalent, and that their cure must vary according to the changes that produced them; and medicines will, under such circumstances, lose much of their power, and even be productive of evil consequences. During fine clear weather, the preparations of mercury seldom affect the bowels, nor do they produce that depression of spirits which is so often observed to accompany their use during damp moist weather. This does not altogether depend upon the state of atmosphere determining from the outward surface, and preventing a free action of the skin, because the coldest weather, if it be dry, is well adapted for its administration. It seems in some measure to be connected with the electricity of the body. We are well aware, if the weather be damp and foggy, that a listless and languid state is produced; while during dry weather, however cold it may be, there is a feeling of light-heartedness and cheerfulness pervading the whole system. In the first instance, the atmosphere is robbing us of our electricity, which it greedily absorbs; in the latter case, the dryness of the air is such, that it leaves us in possession of the electricity which seems to belong to us:

hence the buoyancy of spirits on the cold frosty days of December and January, and the suicidal despondency of November; and hence the elasticity, the life, and animation of the Frenchman—the sluggish, heavy movement of the Dutchman—the variable feelings of the Englishman—one day full of hope and cheerfulness, the next day at war with himself and the rest of mankind. During moist states of the weather, mercurial preparations should be sparingly prescribed; and when, from the diseased state of the system, they cannot be dispensed with, very great attention is to be paid to the clothing. To everyone in damp moist conditions of the atmosphere, flannel is a great comfort, but silk is the most useful covering of the body. It is by far the best friend and comforter that can be applied. We know that if a silk handkerchief be perfectly dry, lightning the most accumulated could not pass through it, so decided a non-conductor is it; hence, if worn next to the skin, the air cannot absorb the electricity of the human body. Silk waistcoats, drawers, and stockings of the same material, are of the greatest service during the humid state of the winter months of this country. The hypochondriac, the nervous, will derive from them more benefit, than from the most active tonic, and they will prove a more invigorating cordial than any spirituous dram; nor are the effects transient, for a buoyancy of spirits and an agreeable warmth are thus diffused over the whole frame.

AUSTRALIA.

THE increasing importance of this vast continent, and the distress which unhappily exists among a considerable portion of our countrymen at home, render every information concerning places reputed eligible for emigration, not only important to those who contemplate quitting this country, but also a subject of deep interest to all good men who are anxious for the well-being of their brethren.

At the last sitting of the Geographical Society, Lord John Russell communicated a letter from Captain George Grey, containing

A Summary of the Discoveries made and objects attained, during an Expedition on the Western Shores of Australia, in the months of February, March, and April, 1839.

The district examined during this expedition, lies between Cape Cuvier and Swan River, having for its northern limit the parallel of 24° S. lat., and for its southern limit the parallel of 32° S. lat. This expedition combined two objects, the examination and nautical survey of such parts of the coast lying between these limits as were imperfectly known, and the exploration of such parts of the continent as might on examination appear worthy of particular notice. The materials for the construction of a chart of that portion of the coast, which had been only so imperfectly delineated by Van Keulen, were first collected; a survey of the unknown parts of Shark's Bay was then completed; in addition to these, I have also the materials requisite to construct a map of the country lying between the limits above named, sometimes extending to the distance of forty miles from the coast. Ten rivers, which are, when considered with reference to the other rivers of Western Australia, of considerable importance (some of them being larger than any others yet found in the south-west of this continent) have been discovered, besides many smaller streams. The rivers I have named the Gascoigne, the Dule Ion (or Difficult Mouth) the Hutt, the Irwin, the Murchison, the Arrowsmith, the Smith, the Greenough, the Garbanap, the Belve-new-Map (or Diminutive River). Two mountain ranges have been discovered. One first seen at the northern extremity of the "Darling Range," and about thirty miles to the eastward of it, lofty and altogether differing in character from the Darling Range, which at this point is called "Moresby's Hat-topped Range;" its direction is nearly north and south. I have taken the liberty of calling this Range after Her Most Gracious Majesty, "The Victoria Range;" and the extensive district of fertile country extending from the base of this range to the sea, and having a length of more than fifty miles in a north and south direction, I have also named the "Province of Victoria," in honour of Her Majesty, trusting Her Majesty will not object to bestow her name upon one of the finest provinces in this her new, vast, and almost unknown empire—and which, protected in its very birth and infancy by her fostering hand, will doubtless, ere long, attain to no mean destiny among the natives of the earth. The other range is thrown off in a westerly direction from the "Darling Range"—it is about forty miles in length from north to south, of a bare, sterile, and barren nature, and terminates seaward in "Mount Perron" and "Mount Le Sueur." To this range I have given the name of "Gairdner's Range;" it forms a very important feature in the geo-

graphy of this part of Australia. Three extensive districts of good country have been discovered in the course of this expedition. The "Province of Victoria" before alluded to, the district of "Babbage," and that of "Gabba-Boola," or Water Abundant. The Province of Victoria is situated between the parallels of 28° and 29° S. lat.; its most considerable river is the "Hutt," which disembogues into a large estuary. A few miles below the estuary the river separates into two branches, both of which were running strong at the time we passed them. Previously to our reaching the "Hutt," our boats had all been wrecked; I had therefore no opportunity of examining whether the estuary of this river was navigable or the contrary. From its size, however, I conceive that it must be navigable. The other principal streams which drain this district, are the "Irwin" and the "Murchison." One remarkable feature in the "Province of Victoria" is, that the carboniferous series is here developed. Throughout a tract of country in Western Australia, extending in latitude from the bottom of "Geography Bay" to "Cape Cuvier," and which I have carefully examined the point above alluded to is the only one in which I have yet found the rocks belonging to this series. This circumstance, therefore, imparts a very high degree of interest to this district. The district of "Babbage" is situated on and near the River Gascoigne, in Shark's Bay. This river discharges itself into the bay through two months, between which lies "Babbage Island." The most southern of these months is situated in 24° 57′ south latitude. This river is the most southern river that I have ascertained to be deficient in that universal characteristic of the rivers in the south-west of this continent —a bar estuary. I have not seen the mouths of three or four of the rivers before enumerated; I cannot, therefore, say that they discharge themselves into estuaries; but at the same time I cannot say that they may not do so. Whereas, the Gascoigne has no estuary, at least in the sense that the term estuary is used in this country, but two months of considerable magnitude. This river is also the most northern river on the western side of this continent, where the rise and fall of tide is sufficiently great to exercise any influence upon it relatively to the purposes of navigation. The rise and fall of the tide here is about 5½ feet; but there is only one regular tide in twenty-four hours. The first tide rises to a certain point, and, ere it has scarcely commenced to ebb, the second tide comes slowly in; so that, to a careless observer, only one tide is perceptible. The district of Gabby-Boola lies immediately to the north of Perth. The largest river in this district is the Garbanap; it, however, contains four other rivers, the Moore River, the Belve-new-Map, the Smith, and the Greenough, or Moore River, about 50 miles to the north of Perth, was before known; a few miles to the north of this river lies the Belve-new-Map; and about 25 miles to the north of Moore River is the Garbanap; into this Moore River discharges itself about nine miles from the sea. The Greenough is situated between this point and "Gairdner's Range," and immediately under this range lies the Smith, which is a large river, even at the distance of thirty miles from the sea coast. Gairdner's Range is naturally the northern limit of this district, which is connected with Perth by a chain of fresh-water lakes—the greatest distance between any two of which is not more than from four to six miles. The whole of this district is therefore immediately available, and affords a gratifying proof that this flourishing colony is by no means deficient in good and immediately available land. The circumstance also of this district being so abundantly supplied with water, even at the end of an uncommonly dry season, which is the period I traversed it in, much enhances its value. There was one other district examined by us, which possesses such peculiar characteristics, that even in this short report I am induced to call your Lordship's attention to it. I have named this the district of "Koo-him-huit," that is, the district of "Falsehood" or "Deceit." It is situated between a point lying about ten miles to the north of the northern mouth of the Gascoigne and Cape Cuvier, the whole extent of its sea-coast is bounded by a range of lofty sandy dunes, having a width inland of not more than from 2 to 2½ miles. The first time that I ascended this range was on the morning of the 8th of March, 1839, at a point about fifteen miles to the south of Cape Cuvier. On looking to the eastward, I was surprised to see an apparently boundless expanse of water in that direction. I hurried back to the boats and selected three men to accompany me in my first examination of the shores of this inland sea. When we gained the top of the sand-hills, the surprise of the party was as great as my own, and they begged me to allow them to return, and endeavour, by the united efforts of the party, to carry one of the whale-boats over the range, and at once launch

it on this body of water. I, however, deemed it more prudent, in the first instance, to select the best route along which to move the whale-boat, as well as to choose a spot which afforded facilities for launching it. In pursuance of this determination, we descended the eastern side of the sand-hills, which abruptly fell in that direction, with a slope certainly not much exceeding an angle of 45°. I now found that the water did not approach so near to the foot of the hills as I had at first imagined; but that immediately at the foot of these hills lay extensive plains of mud and sand, at times evidently flooded by the sea, for on them lay dead shells of many kinds and sizes, as well as large travelled blocks of coral. The water now appeared to be about a mile distant; it was also apparently boundless in an easterly and north-easterly direction, and was studded with islands. We still felt convinced that it was water we saw, for the shadows of the low hills near it, as well as those of the trees upon these hills, could be distinctly traced on its unruffled surface. As we continued to advance, the water, however, constantly retreated before us, and at last surrounded us. We had been deceived by mirage! The islands are really so when the plains are covered by water. In many places the sandy mud was still so moist, that we sank deeply into it, and, after travelling for fifteen miles on a N.E. course, I could still see no limit to these plains in a N.E. direction, nor could I either then, or on any subsequent occasion, find the channel which connected them with the sea. We dug in several places in these flats, and in their vicinity, but could only find salt water; whereas in the narrow range of sand-hills separating them from the sea, we found abundance of fresh water only four or five feet below the surface of the valleys between these hills. As this range of hills, more than thirty miles in length, offers many geological phenomena, I have named it "Lyell's Range," in compliment to the distinguished geologist of that name.

THE CHEMIST.

THE ELEMENTS AND THEIR COMBINATIONS.

(*Continued from page* 147.)

HYDROGEN was first examined in its pure state by Mr. Cavendish, in 1766. It was termed *inflammable air*. To procure it, let sulphuric acid, previously diluted with six or eight times its weight of water, be poured upon iron filings or granulated zinc in a gas bottle, an effervescence will immediately ensue, and the evolved gas may be received in the ordinary manner by the hydro-pneumatic apparatus. It may also be procured by heating turnings of iron heated to redness in a gun barrel. The hydrogen, however, which is thus obtained is never perfectly pure. When procured by the means of iron, its odour is peculiarly disagreeable, in consequence, according to Berzelius, of its containing a portion of volatile oil formed by its union with a minute quantity of carbon, which all common iron contains. For the purpose of delicate experiments, hydrogen must be passed through a solution of potassa collected over mercury, and should be procured from purified zinc and sulphuric acid so far diluted as to act slowly on the metal. The hydrogen liberated by the voltaic decomposition of water by platinum wires, may, when dried, be considered perfectly pure. Hydrogen is a uniform fluid not absorbable by water unless that liquid has been previously deprived, by boiling, of common air, in which case 100 cubical inches dissolve about 1.5 cubic inches of the gas; it has no taste, and when perfectly pure is inodorous. It is the lightest body known, and we therefore conveniently assume it as unity in speaking of the specific gravity of gases. It is inflammable and extinguishes flame. When pure, it burns quietly with a lambent blue flame at the surface in contact with air, but if mixed with thrice its volume of air it burns rapidly and with detonation; it is the body which gives the power of burning with flame to all the substances used for the economical production of heat and light. In making the detonation experiment with hydrogen, a strong bottle, capable of holding about six ounces of water may be employed, but it should be wrapped round with several folds of cloth to prevent the glass being scattered about. In examining into the quantity of atmospheric air required to form an explosive mixture with hydrogen, Mr. Cavendish found the loudest report was produced by two volumes of hydrogen with six of air. One of hydrogen with nine of air burned very feebly, and four of hydrogen with one of air burned without explosion. If two volumes of hydrogen and one of oxygen be burned in the vial in the same manner as before stated, the explosion is extremely violent; but if the mixture be diluted with eight measures of hydrogen or nine of oxygen, it becomes uninflammable.

Hydrogen, in consequence of its extreme lightness is employed for filling air-balloons. If an inverted jar of this gas be brought over the wick of a lighted candle, and suddenly depressed, so that the flame may be entirely surrounded by the gas, it will be extinguished, although the gas will burn in contact with the atmosphere. On account of the extreme levity of this gas, it may be apparently breathed some time without inconvenience, provided that the lungs at the outset are filled with common air; but if a forcible expiration be made before drawing in the hydrogen only two or three inspirations of the latter can be made, and even these produce great feebleness and oppression about the chest.

J. MITCHELL.

(*To be continued.*)

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street.—Thursday, Feb. 13, Mr. Sainsbury, on Chemistry. At half-past eight.

Poplar Institution, East India-road.—Tuesday, Feb. 11, General Meeting. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney-road.—Tuesday, Feb. 11, G. Francis, Esq., on Modelling and Casting. At eight o'clock.

QUERIES.

A receipt for the preparation of the creta lævis?

J. F. B.

How to make a good red black spangled wax?

P. Y. H. N.

Where to get two glass cylinders of the following dimensions—1 and 2 inches in diameter, and 2 to 4 inches long? TYRO CHEMICUS.

1. What is the best and cheapest book extant on the formation of millgeering? 2. Which is the best mode of drawing an epsceloid? 3. The best mode of striking out bevel wheels? 4. Which is the best method of forming the teeth of large wheels? YOUTH.

I find that in No. 63 (N.S.) "T. L." has kindly offered to give information on the construction of a velocipede; I shall feel it a great favour to receive a plan of one on the best principles? Also the best way to piece China to hold hot water, and to make holes in it? How to colour coral that has been made white through being heated? Will soda or potash counterfeit coral instead of wood ashes; if not, what kind of wood is best to make the lye? A. ADAMS.

How to make modelling-wax? P. T.

ANSWERS TO QUERIES.

To make Gas which takes Fire on coming into contact with the Air.—Put a piece of phosphuret of calcium, or phosphate of lime, into a glass of water; the water will be decomposed, and phosphuretted hydrogen produced, which will take fire as the bubbles reach the surface. To make phosphate of lime, put some pieces of red-hot lime into a basin, throw upon them a piece or two of phosphorus, and cover the basin instantly with a board. Let it remain till cold.

W. W.

To make Congreve Matches.—Take 1 part phosphorus, 1 nitre, 1 chlorate of potash, 1 sulphuret of antimony, 3 gum water of the consistency of cream. Place them in a cup, and set the cup in hot water. As the phosphorus melts, stir the ingredients together till thoroughly evaporated. Dip sulphured matches into the mixture.

Wallace's "Mathematician's Pocket Guide," contains logarithms of numbers to 10,000, as well as of sines and tangents, and costs but a trifle. It is, indeed, an excellent little book.

W. W.

TO CORRESPONDENTS.

Wm. Jonquest.—*Several modes of constructing garden fountains have been described in former numbers of this work; a simple jet is produced by a water-butt or other reservoir being placed a few feet higher than the fountain, and a tube to convey the water to the jet, when the force of projection will be found proportional to the height of the water in the reservoir above the mouth of the fountain, whatever may be the position or devious course of the tube.*

Tyro Chemicus.—*We not only take great interest in the success of the society he is about to form, but shall be most happy to do all in our power to promote its success. The letter addressed to "J. C." we have forwarded by post. He will receive all the information of which we are possessed, upon the subject of his inquiry.*

J. Kentish *will find his request complied with.*

J. C.—*We are happy to announce, that our worthy and talented correspondent, "G. Piesse," is disposed to join a society of the kind spoken of by "J. C." and "Tyro Chemicus." He says, "I am willing to join any party for the formation of a society as spoken of by 'J. C.', 21, Great Newport-street. Should any of the readers be of the same inclination, let us hold a meeting; anywhere that is mentioned will suit me." We should recommend by all means that the above gentlemen meet, and, if they agree, success is certain.*

J. Yates's *solution shall appear in our next number.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and News men in Town and Country.

THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 76 & 77, NEW SERIES. | SATURDAY, FEB. 15, 1840. (PRICE TWOPENCE.) | Nos. 197 & 198, OLD SERIES.

OPTICAL INSTRUMENTS.

FIG. 1.

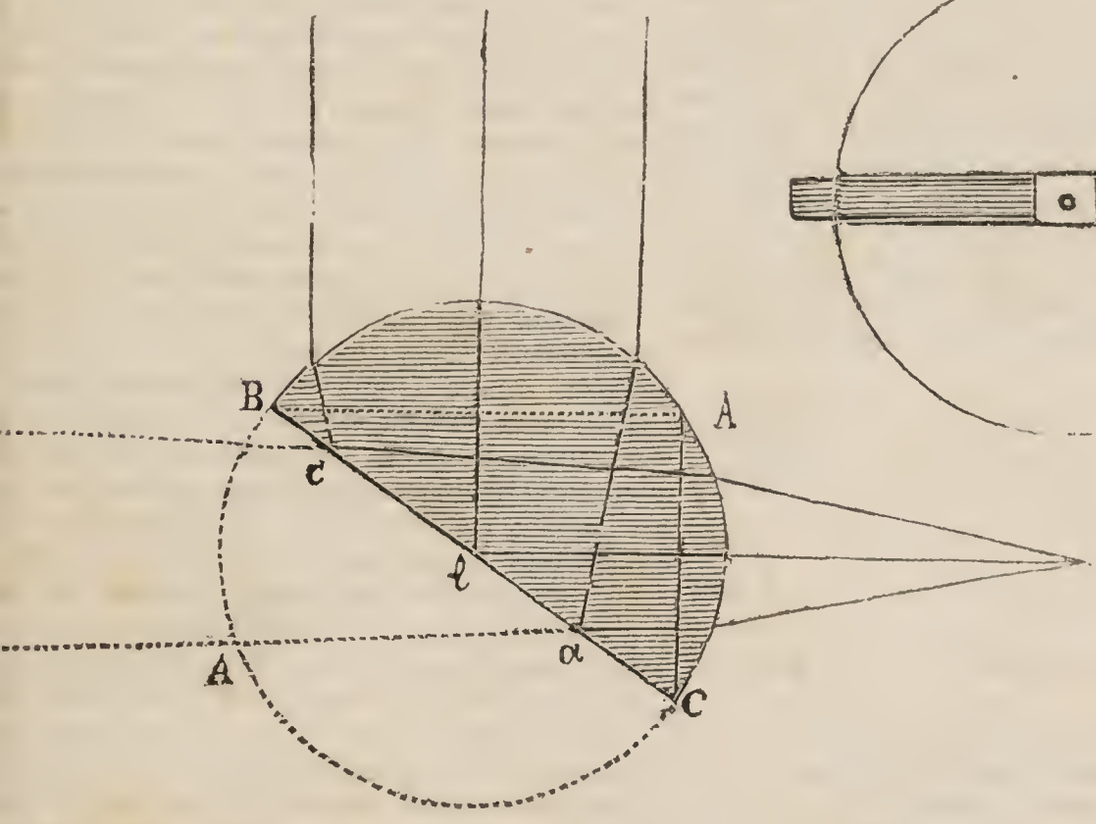


FIG. 2.

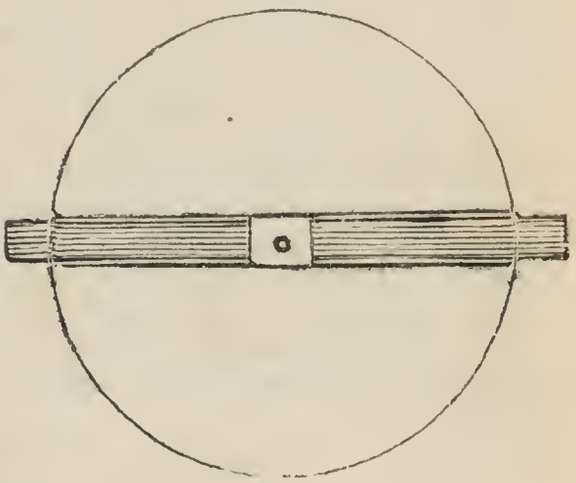
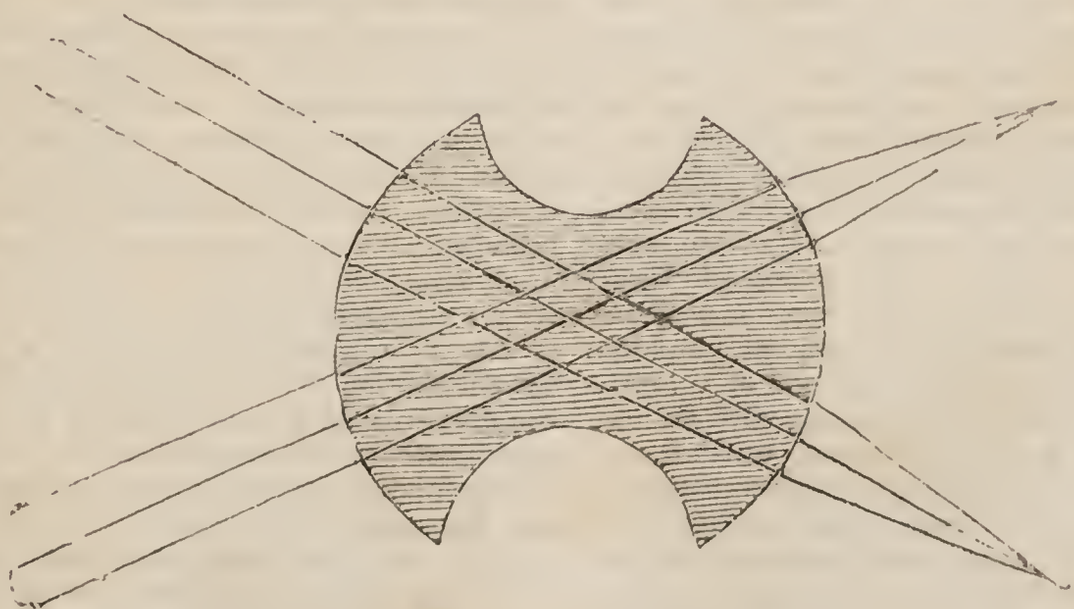


FIG. 3.



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OPTICAL INSTRUMENTS.

NO. VI.

(See Engraving, front page.)

A MICROSCOPE is an optical instrument for examining and magnifying minute objects. Jansen and Drebell are supposed to have separately invented the single microscope, and Fontana and Galileo seem to have been the first who constructed the instrument in its compound form.

Single Microscope.—The single microscope is nothing more than a lens or sphere of any transparent substance, in the focus of which minute objects are placed. The rays which issue from each point of the object, are refracted by the lens into parallel rays, which, entering the eye placed immediately behind the lens, afford distinct vision of the object. The magnifying power of all such microscopes is equal to the distance at which we could examine the object most distinctly, divided by the focal length of the lens or sphere. If this distance is five inches, which it does not exceed in good eyes when they examine minute objects, then the magnifying power of each lens will be as follows :—

Focal length in Inches.	Linear Magnifying Power.	Superficial Magnifying Power.
5	1	1
1	5	25
$\frac{1}{10}$	50	2,500
$\frac{1}{100}$	500	250,000

The *linear* magnifying power is the number of times an object is magnified in length ; and the *superficial* magnifying power is the number of times that it is magnified in surface. If the object is a small square, then a lens of one-inch focus will magnify the side of the square five times, and its area, or surface, twenty-five times. The best single microscopes are minute lenses, ground and polished on a concave tool ; but as the perfect execution of these requires considerable skill, small spheres have often been constructed as a substitute. Dr. Hook executed these spheres in the following manner :—Having drawn out a thin strip of window-glass into threads by the flame of a lamp, he held one of these threads with its extremity in or near the flame, until it ran into a globule. The globule was then cut off, and placed above a small aperture, so that none of the rays which it transmitted passed through the part where it was joined to the thread of glass. He sometimes ground off the end of the thread, and polished that part of the sphere. Father di Torre, of Naples, improved these globules, by placing them in small cavities in a piece of calcined tripoli, and remelting them with the blowpipe ; the consequence of which was, that it assumed a perfectly spherical form. Mr. Butterfield executed similar spheres, by taking upon the point of a wetted needle some finely pounded glass, and melting it by a spirit-lamp into a globule. If the part next the needle were not melted, the globule was removed from the needle, and taken up with the wetted needle on its round side, and again presented to the flame, till it was a perfect sphere. M. Livright, of Meggetland, has made lenses by putting pieces of glass in small round apertures, between the tenth and twentieth of an inch, made in platinum leaf. They were then melted by the blowpipe, so that the lenses were made and set at the same time. Mr. Stephen Gray made globules for microscopes, by inserting drops of water in small apertures. Dr. Brewster made them in the same way with oils and varnishes ; but the finest of all single microscopes may be executed by forming minute plano-convex lenses upon glass with different fluids. The most perfect single microscopes ever executed of solid substances, are those made of the gems, such as garnet, ruby, sapphire, and diamond. Lenses made of these stones perform admirably, in consequence of their producing, with surfaces of inferior curvatures, the same magnifying power as a glass lens ; and the distinctness of the image was increased by their absorbing the extreme blue rays of the spectrum. Mr. Pritchard, of London, has carried this branch of the art to the highest perfection, and has executed lenses of sapphire and diamond, of great power and perfection of workmanship.

When the diamond can be procured perfectly homogeneous and free from double refraction, it may be wrought into a lens of the highest excellence. Garnet is decidedly the best material for single lenses, as it has no double refraction, and may be procured, with a little attention, perfectly pure and homogeneous. A single microscope, which Dr. Brewster used, is shown in fig. 1, and consists in using a hemispherical lens, so as to obtain from it twice the magnifying power which it possesses when used in the common way. If A B C is a hemispherical lens, rays issuing from any object, B, will be refracted at the first surface, A C, and after total reflection at the plane surface, B C, will be again refracted at the second surface, A B, and

emerge in parallel directions, *d e f*, exactly in the same manner as if they had not been reflected at the points, *a b c*, but had passed through the other half, B A C, of a perfect sphere, A B, A C. We obtain, consequently, by this contrivance, all the advantages of a spherical lens, which has never been executed by grinding. The periscopic principle, which I shall presently mention, may be communicated to this *catoptric* lens, as it may be called, by merely grinding off the angles, B C, or roughly grinding an annular space on the plane surface, B C. The confusion arising from the oblique refractions will thus be prevented, and the pencils from every part of the object will fall symmetrically upon the lens, and be symmetrically refracted.

Dr. Wollaston proposed a method which is shown in fig. 2. He introduced between two plano convex lenses of equal size and radius, a plate of metal with a circular aperture equal to one-fifth of the focal length; and when the aperture was well centered, he found that the visible field was 20° in diameter. In this compound lens the oblique pencils pass, like the central ones at right angles, to the surface. If we compare this lens with the *catoptric* (one above described) we shall see that the effect which is produced in the one case, with the two spherical and two plane surfaces, all ground separately, is produced in the other case, by one spherical and one plane surface. Dr. Wollaston's method may, however, be improved by filling up the central aperture with a cement of the same refractive power as the lens; or, what is far better, by taking a sphere of glass and grinding away the equatorial parts, so as to limit the central aperture, as shown in fig. 3; a construction which, when executed in garnet, and used in homogeneous light, will be the most perfect of all lenses, either for single microscopes, or for the object lenses of compound ones. When a single microscope is used for opaque objects, the lens is placed within a concave silver speculum, which concentrates parallel or converging rays upon the face of the object next the eye.

A. D. M.

STEAM NAVIGATION.

To the Editor of the Mechanic and Chemist.

Sir,—Annexed we have the pleasure to hand you the result of an experiment made by us on board the *Maria*, of applying steam power as an auxiliary aid to shipping during calm light weather.

From a careful inspection of the *Maria's* logbook, and Captain Black's memoranda, we find, that the two ten-horse engines with which the ship was fitted, propelled her in a calm, at the rate of three miles per hour. When the ship's draught of water, and the smallness of the power employed, are considered, this result of a first experiment must be deemed by nautical men as very satisfactory. The obstacles to complete success are of a description easily overcome; and such data have been afforded for farther improvements, as experience alone could furnish.

Having at our sole expense fitted this, the first ship, with steam-power for occasional use, we shall be happy to afford Her Majesty's Government, the Honourable East India Company, or any public body, all the information in our possession on this very important subject. There cannot, we imagine, be any difference of opinion respecting the utility to all sailing vessels on distant voyages with troops, emigrants, &c., of this partial application of steam-power; at the same time it must be obvious, that the repetition of similar undertakings, or the establishment of a line of packet ships for the passengers and trade to and from India, fitted like the *Maria*, involves an outlay of capital which few private individuals possess the means of expending.

The experiment referred to, forms our contribution towards effecting so great an improvement in navigation; we have now only to express our undiminished confidence in Mr. Melville's invention, and hope it may be generally adopted for the advancement of the naval and commercial interests of our country.

Your obedient servants,
Gardner, Urquhart, & Co.,
Owners of the Ship *Maria*.

11, St. Helen's Place, London,
20th January, 1840.

It appears from an abstract of the logbook, that, during the voyage, the steam-power was used on forty-five different occasions, and during a period of 511 hours = 21 days, 7 hours. If the result has proved less brilliant than might have been anticipated, it was owing to the appointment of improper persons as engineers. The following extracts from the logbook will show under what disadvantages the experiment was conducted: — Feb. 12: "Found engineer neglectful and inefficient. March 17: At 3 a. m., lighted the fires: but, owing to the ignorance and neglect of engineers, did not get the steam up until 9 a. m." Upon almost every occasion on which the steam-power was used, the discreditable conduct of one or both of the engineers is recorded; one of them

was for a period kept in confinement for theft and drunkenness. Notwithstanding these unfavourable circumstances, the occasional application of steam-power appears to have considerably shortened the period of the voyage; indeed there is little doubt of its ultimate adoption, not only in trading vessels, but also in the Royal Navy—especially in the latter, where the celerity of movement is of such vast importance during an engagement.

ON LIFE ASSURANCE.

(*Continued from page* 171.)

Most of our readers must be acquainted with the mariners' legend of the "Flying Dutchman." An unearthly being, supposed to be the commander of the *Phantom Ship*, is represented to be constantly contriving pretences for delivering a letter to the captain of some devoted vessel; and, when he succeeds, the vessel, on board of which the letter has been received, is doomed to certain and speedy wreck and destruction. The enticing prospectuses of fraudulent Assurance companies have often brought more misery and ruin to families, than credulous seamen have supposed the Dutchman's letter to entail upon a ship. During the short period which has elapsed since we intreated our readers to beware of delusive advertisements, and keep their money secure from intriguing and heartless speculators, another "breaking up" is added to the list of 37 mentioned in a former article. The "Royal Union Association" has ceased payment, and thereby inflicted utter ruin upon many poor and honest families. One old lady had invested 500*l.* in this "concern;" it was all she possessed in the world, and would have produced her a comfortable income for the rest of her days—she must now be locked up in a workhouse prison, to pine away till grief and fruitless regret shall close her poor eyes in that long sleep, which is the only solace for the child of misfortune and adversity. The following extract from the proceedings before the magistrates at Bow Street, exhibits the feeling of just indignation excited among the numerous victims; many of whom had come from Scotland and other distant places, in the hope of recovering some wreck of their property:—

"Mr. Twyford said, that however much he might regret the misery which the state of the Society's affairs would entail upon numerous parties who were ill able to bear up against it, still he was of opinion that the case was one in which he could not render any assistance; in fact, it was clear, that whatever proceedings might be adopted, the annuitants would never get back one penny of their money.

Mr. Cheaper said, that the public ought to be furnished with a list of the names of the parties, on the faith of whose responsibility people had been induced to trust their money with the Society.

Mr. Cross begged that their names might not be mentioned.

Mr. Cheaper.—Why not? They have drawn unsuspecting people into a snare, and totally ruined them. It is a disgrace to the country that such a thing should be tolerated. Thank God I am better able to bear the loss I have sustained than the poor people by whom I am surrounded!

Mr. Mingay said, he had invested 200*l.* in the Society within the last six months, for which he had never received a farthing interest.

[Here there were loud exclamations of 'Is there no way of bringing the rascals to justice? They ought to be hung. The attorney ought to be ashamed of such clients.']

Mr. Cross said, that a bill in Chancery had been filed by one of the annuitants, a Mr. Colesbrook, of Newbery, calling for an account of the manner in which the funds of the Society had been disposed of, that account was being prepared, and would be filed as soon as possible."

We shall return to this important subject, and perform the more pleasing task of examining the principles of some of the substantial, honourable, and benevolent institutions, which are as deserving of support, as others are of the universal execration they have called down upon themselves.

(*To be continued.*)

LOAN SOCIETIES.

To the Editor of the Mechanic and Chemist.

Sir,—You having treated some information upon "Loan Societies" most judiciously in your last number, and, considering as I do, that the subject cannot be unsuited to those of your readers, who, from the very nature of some of their projections, would be apt to avail themselves of a loan; permit me to call your attention to a few words farther upon the subject. In doing this, I alike address myself to those who may, and those who may not, require loans.

The statements of "W. M'C," which you strongly commented upon, I deem a decidedly moderate example of more than fifty societies in the metropolis. How far I may be considered to possess grounds

for this assertion, let the following experience testify. I have carefully examined the rules of many of these societies, and adduce the fact, that very little deviation is made from the following principle; namely, 1. Interest; 2. Entrance money; 3. Cost of books and papers; 4. Securities' expenses; 5. Reserve fund to meet losses; 6. Secretary's salary; 7. House rent, of course chargeable in common to all; but should there be any default, there is added. 8. Expense of writing letters; 9. Postage; 10. Fines. It is needless to proceed farther. I read in the first section of the Act which empowers those persons who commit such depredations on the pockets of our valuable artisans and mechanics under a mask, that this statute was created to "assist the working classes of Great Britain." And is it possible, some may ask, that such freedom is taken with our legislature? Certainly it is possible; for a clause gives them also the power to make rules for "management" and "expenses;" and a farther clause to make these rules "binding" on all parties; so that where "joint-stock" affairs, with raised capital, &c., are to be found, such unprincipled means of extortion are generally practised. I am aware of an individual some time since lending 100*l.* to one of these companies, and, at the end of the year, his dividend was 20*l.*! Mark, this Society was held at a publichouse; and it is astonishing to me, that with all our advances to the "city of science," our *assistance* societies are found to retrograde thus in the path of scorn; for I hold it but an honourable appellation to the names of all your readers (many of whom I personally know) that their exalted aim is to expel this demoralizing bane from the page of their research; yet, if borrow they would, not only is the pocket robbed, but the senses too: it becomes a disgrace to put in practice their motto, "No spending money;" for never did any of their patrons (I mean publicans) ever anticipate such a thing.

You have given your readers, Sir, a very correct outline of the old system; permit me now to introduce the new. It would be easy enough to swell the scale of comparison between the two, but I forbear; enough has been said upon that score.

Let then, for example, a Society be formed to advance sums under the statute quoted, of 10*l.* or 15*l.* to each person, and let the interest of five per cent. be deducted at the commencement, as being more convenient to both borrower and lender; and this the Act permits. Then, with a sufficient security, a person might pay back 10*l.* in twenty-five weeks by 8*s.* each instalment, without addition. The person to whom the 10*l.* had thus been lent, would be indeed assisted; for it is clear, all he ever paid was interest 5*s.*! and would be at liberty to use another 10*l.*, or even 15*l.*, the remaining half-year. Now by returning by instalments his money regularly, which puts fines out of the question, the Society have, it is true, realized rather more than 5 per cent; but not enough to make good losses; neither is a bare five per cent. expected to pay expenses; but I could show a just and honourable method by which the borrower should pay no more, and yet the Society be not subject to the loss of expenses of management. This I will make the subject of another paper; in the mean time allow me to state, that this Society does exist precisely upon the principle stated, only making a little distinction with regard to security, which no industrious man could object to; and it is probable that this will meet the eyes of some who have been "assisted" thereby during the past year, and the truth will need no confirmation. No advertisements or flaming handbills have been issued, as is usual; for the question, Who would pay it? Should the borrowers?

I remain yours, &c.,

SIGMA.

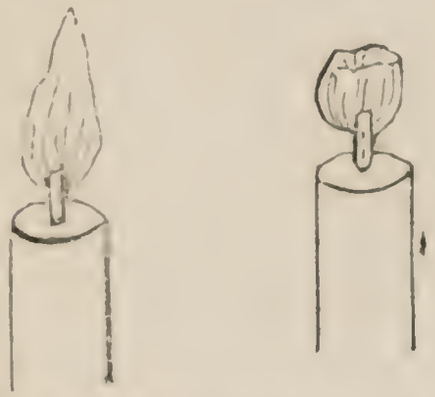
ON COMBUSTION.

IN a chemical sense, this term is applied to all those cases of combustion which are attended with the evolution of heat and light. Combustion in atmospheric air (which branch I intend to examine) is simply the combinations of the oxygen it contains. We are indebted to Lavoisier for the true theory of combustion; he attributing it to the combination of inflammable bodies with oxygen; heat and light being evolved by the fact of gases containing a larger quantity of caloric than liquids, and liquids than that of solids. Gaseous bodies emit the greatest quantity of light while they are burning, a flame being produced by their combustion. Solids give a fixed light. Coals producing flame from the volatilization of the gaseous matter; but when expelled, producing a fixed light. Sir Humphrey Davy supposes, that the degree of light depends on the quantity of solid matter present in the burning gas. When any solid substance is introduced into a feeble flame, it becomes brighter, and, if combustible, brighter still. A considerable quantity of carbon is disengaged from carburetted hydrogen dur-

ing its combustion, which gives that brilliancy to the flame.

A candle may be compared to a small gas manufactory, where the gas is consumed as it is produced. The flame of a candle is produced by the oxygen of the air acting upon the outside of the formed gas; water and carbonic acid being produced by its combination. The flame of a candle is hollow, assuming the conical form, in order to be supplied with oxygen, as fig. 1. But if a heated wire be passed down the centre of the wick, and through the side, and then drawn out so as to leave a passage for the air, the flame will assume the form of fig. 2; it then being

Fig. 1. Fig. 2.



supplied with a current of oxygen on both sides of the flame. The following experiments prove that flame assumes the form of a hollow cone, when a current of air is not allowed to pass through it.

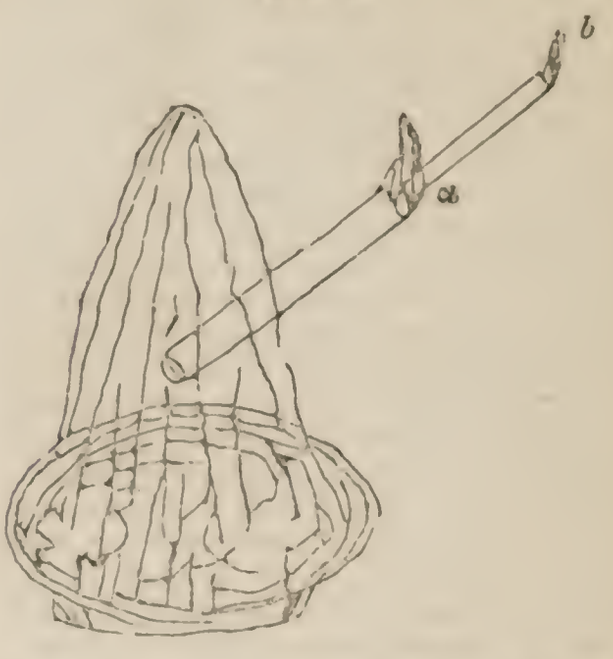
Exp. 1. Take a small plate, about two inches in breadth, and pour a little spirit of wine in it; upon setting fire to it, it will assume the conical form; take a piece of chip, and hold it through the centre of the flame, it will be found to burn only at the points, *a a*, fig. 3; the centre falling through.

Fig. 3.

Exp. 2. Place a piece of phosphorus in the centre, it will not be inflamed; in the same way sulphur, &c.

Exp. 3. If a glass tube be introduced within the flame of the burning spirit, in the manner represented in fig. 4, part of

Fig. 4.



the unconsumed vapour passes through, and may be kindled at *a*. The wider the tube the better; if the flame is sufficiently large, and a tube being thrust into the flame at *a*, the vapour may be also kindled at *b*. This experiment is best done with a large candle, and proves that the centre of a candle, lamp, &c., is filled with the unconsumed gas, which rises to be decomposed in its turn.

Felix Weiss.

Liverpool, Feb. 4.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 194.)

Another peculiarity connected with the arteries, is the manner in which they are distributed to the different organs of the body. As they alone convey the vital stream that carries with it life and nourishment, we might naturally conclude, that the most important organs would have the greatest number; and such we find to be the case. According to the importance of a part, so is its supply of arterial blood. The brain, for instance, being the centre of sensation, and the source of life and action, receives more blood than any other portion of the body. It has four large arteries, which rise almost direct from the heart; and these vessels communicate so freely with each other by means of branches, that if three were stopped up, the fourth would supply their place for a time. There are no vessels, indeed, in any part of the body that so

reely communicate with each other, as those of the brain; and the importance of this arrangement will be obvious, when it is considered, that if the supply were cut off even for a few seconds, death would instantly ensue. How astonishing it is to think, that every moment of our lives there is a constant current of blood rushing to our brains, and yet that we are quite ignorant of the fact, except in periods of great excitement, when we may feel it throbbing in our heads; or in those disorders where our being sensible of the circumstance is the occasion of continual pain and misery! "The four arteries just mentioned, alone convey to the head," says John Bell, "the fifth part of the whole mass of blood." Even those who settle it at the lowest point, still acknowledge that the arteries going to it receive at least a tenth of all the blood of the body. Thus the brain, which weighs not above the fortieth part of the whole body, receives one-tenth of all the blood! Besides the profusion of blood which thus rushes into the brain, the impetus with which it forces its way seems dangerous; and Nature also seems to have provided against the danger. We cannot but be sensible of the danger, for the slightest increase of velocity occasions strange feelings, if not absolute pain. We cannot run for any distance, nor ascend a stair rapidly, nor suffer a paroxysm of fever, nor, in short, have the circulation quickened by violent exertions, by emotions of the mind, or by disease, without feeling an alarming beating within the head. If it continue from disease, or we persist in our exertions, giddiness, blindness, ringing of the ears, come on. Haller, the celebrated physician, says, that while he was afflicted with a bad fever, he suffered so much from the pulsation of the artery within the skull, that his head was lifted from the pillow at every stroke. Did this vast column of blood rush directly to the brain, which is more delicate in its structure than any other organ of the body, the most serious consequences would follow. In order, therefore, to break the force of the ascending current, many beautiful contrivances have been adopted. In man, the blood is retarded chiefly by the tortuous course which the artery is obliged to follow; and by a long bony canal, which, by holding the artery, as in a sheath, suppresses its violent action, and prevents its being dilated by the force of the blood. It is also peculiar in all the arteries of the brain, that they do not enter in trunks into its substance. This seems to be a violence which the soft texture of the brain could not bear; all the arteries are, therefore, attached to an exceedingly delicate membrane (the pia mater) which is the immediate covering of the brain, which follows all its divisions, lobes, and convolutions; which enters all its cavities, and lines its internal surfaces, as it covers the external. This is the membrane of the brain to which the arteries attach themselves. It conducts them everywhere along the surface of the brain, and into its cavities; and, when the arteries are to enter into the substance of the brain, they have already branched so minutely upon this membrane, that they enter into the pulpy substance in the most delicate twigs. In the lower animals, especially in the calf, the deer, the sheep, which hang their heads in feeding, there is a provision of so singular a nature, that we can have no doubt that these contortions of the great trunks and minute divisions of the smaller arteries in man, have the same final cause; for in those creatures the principal arteries, before they enter the brain, first divide into innumerable small arteries. Not one of these is sent off for any particular function; but they are immediately united again, and gathered together into one trunk, and then the force of the blood being thus broken, the artery divides a second time into branches of the ordinary form, which enter safely into the substance of the brain.

Having thus described, to a certain extent, the system of vessels by which the blood is conveyed *from* the heart to the various organs of the body; we have now to consider the vessels by which it is conveyed *back* to that organ—these are the veins. Before describing them, however, there is an intermediate class of vessels to be noticed, which possess some striking and remarkable peculiarities—they are termed the capillaries.

The capillaries are the extreme ends of the arteries and veins. They are called capillaries, because they are supposed to be as small as a human hair; but, in point of fact, they are infinitely smaller. They are generally described as a distinct system of vessels, although they are known to be merely the fine terminations of the arteries, and beginnings of the veins; because, as I have stated, they possess certain peculiarities that do not belong to either arteries or veins. They are the vessels that connect the two systems. An artery, as it proceeds from the heart, becomes gradually smaller, decreasing in size until it becomes so small, that it loses its characteristics of an artery, and is then termed a capillary vessel. This vessel, after proceeding some distance, gradually increases in size till

we find it at the commencement of a very small vein, which, as it approaches the heart, unlike the artery, continues to become larger, and, uniting with other veins, at last forms the great vena cava, which forces all the blood of the body into the right auricle. In the passage of the vital fluid through the capillaries, a great change occurs in its properties. It loses much of its vitality, and, at the same time, the bright red colour it had in the arteries, which is changed to a purple hue, as we see in the veins when they are swollen. The under part of the wrist, when the hand is warm, and held down the side of the body for a few moments, exhibits most beautifully the colour of the veins, and is, indeed, quite a picture to contemplate, as far, at least, as regards a beautiful variety of colours.

The capillaries exercise a considerable influence on the circulation. Though so exceedingly small, their muscular coat is very strong, much stronger, indeed, in comparison, than the same coat on the arteries; and, by its means, they can retard or accelerate the passage of the blood through them to a surprising extent. They are strongly influenced by the emotions of the mind, and often afford us the means of knowing something of "that within which passeth show." Thus, for instance, when the mind is under the influence of extreme terror, these vessels almost stop the circulation. We see the effect in the countenance, which then becomes of an ashy paleness, and the hue of health flies from the cheek the moment its cause—the unceasing circulation of a stream of blood in these small vessels—is interfered with. Again, under the influence of sudden joy, the capillaries expand, and allow a quicker and more powerful current to pass through them than usual, making the eye beam with lustre, and giving to the whole countenance an expression of happiness that cannot be described. You are all aware, too, what an effect shame has upon these surprisingly minute, yet powerful vessels. They enlarge so suddenly, that the face becomes suffused with blushes, and its scarlet colour shows how powerfully the mind has acted upon the cause which has produced these appearances. The sudden flow of tears which follow certain passions of the mind, is, no doubt, likewise attributable to these capillaries; and they probably exercise a far greater influence on the circulation than is generally imagined. They produce one curious effect which, no doubt, was the cause of the circulation remaining undiscovered for so great a length of time. They empty the arteries of all the blood they contain after death; so that in the dead body no blood is found in the arteries, but all in the veins. This led the ancients to believe, that the arteries were always empty of blood, and imagine that they were only for the purpose of conveying a certain ethereal fluid, which they called the vital spirits—to the different organs.

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Let us now pause for a moment, and see how far we understand the organs of the circulation. First, then, I have described to you the necessity for some organ capable of forcing the blood from some given point in the body to its various parts, such as we find in the heart. I have pointed out to you the situation and form of this organ, the various chambers of which it is composed, the manner in which it is excited to action, and the purpose it fulfils. Then we mentioned the principal facts to be noticed in connexion with the vessels conveying the blood away from the heart—the arteries; the different coats of which they were composed, the various uses they performed, and the protection afforded to preserve them from injury; at the same time, the manner in which they were distributed to the different organs, and the effect produced by the difference in distribution demanded our attention; and, lastly, we considered the peculiar features which distinguish the vessels which assist in returning the blood to the heart, their dependence on the emotions of the mind, and in the veins, the reason why exercise is of such benefit and importance.

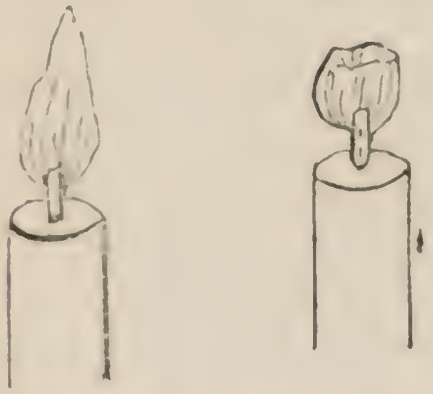
Thus far, then, I have described all that it might appear necessary to know, in order to understand the circulation of the blood. The great discoverer of the circulation, the illustrious Harvey, thought that it was by the action of the heart alone that it was accomplished; but subsequent discoveries have shown that this cannot be the case. Although the left ventricle of the heart is an organ of great power, it is not sufficient of itself to cause the blood to perform a complete circuit, and there are various assisting causes that co-operate to produce this effect. That the heart alone is not the moving cause, may be proved by several striking facts; but the following may suffice, because it is conclusive:—If we tie an artery, it will be found that the blood in the part beyond where it is tied, and which consequently cannot experience any effect from the contraction of the heart, will yet proceed onwards in its course; and if a vein be tied, the portion of it between the heart and the place where it is tied, will be emptied of its contents, although the blood in this case is of course relieved from any upward pressure of the returning current. These facts of themselves satisfactorily prove, that the heart alone is not the prime mover; but it will be rendered yet more evident, if we consider that the blood in the course of its circulation, passes through a series of capillary vessels, where it is quite impossible the heart's power can be felt to any extent. It was mentioned, when describing the means adopted to prevent the blood having too great a force on its entrance to the brain, that the means adopted were the subdivision of the arteries into numerous capillaries. Now the same effect must be produced in both cases; the force of the blood is diminished, and it is unreasonable to suppose, that in the case of the body it still possesses sufficient impetus to force its way upwards to the heart. Some physiologists have supposed the right auricle to possess what they termed a suction power, by which it drew into it the ascending blood; but this cannot be the case; for if we take a flexible tube, like one of the veins, and attempt to suck up any fluid through it, we shall find, that after a very small quantity has been drawn up, the sides will be pressed together in consequence of a vacuum having been formed, and no exertion will enable us to draw up any farther quantity.

The power of the heart is quite sufficient to account for the passage of the blood to the capillaries, and it is much greater than we might imagine. Smith says, that from experiments carefully made and frequently repeated, it is believed that the left ventricle projects its blood into the aorta with a velocity equal to twenty-one feet in the minute. Dr. Haller states, that the internal area of the left ventricle of the heart is equal to fifteen square inches; these multiplied into seven feet and a half (the height to which he calculates by experiment on animals, that the blood would rise in man above the level of the heart) give 1350 cubic inches of blood, which press upon that ventricle when it first begins to contract—a weight equal to 51—5 pounds. Supposing that the quantity of blood taken into the heart during each dilatation be two ounces and a half, that the heart contracts seventy-five times in a minute, and that thirty pounds represent the quantity of blood circulated in the body of a moderately-sized man, the whole mass will pass through the heart twenty-three times every hour, and an entire circulation will be performed every three minutes. The passage of the blood in point of rapidity is not, however, equal throughout its course. If we place one knee over another while sitting down, we shall observe that the foot will be raised every time the heart pulsates; and if we consider how great a weight this is to raise, merely by the tendency of the blood to continue in a direct course, in consequence of its inertia; we shall see that the force of this current of blood must be very considerable. The blood has two complete and distinct circulations to perform:—First through the lungs, in order to have the impurities it has contracted removed, by being brought into contact with the air; and, secondly, through the body, in order to supply every organ with vitality and nourishment. The means by which this is really effected, so far as the heart's action is concerned, has been clearly, and, I think, satisfactorily described by Dr. Southwood Smith, in his treatise forming part of the "Library of Useful Knowledge." "The heart is a hollow muscle, possessing both elastic and contractile powers. Its contractility depends on the muscular fibres, of which it is principally composed; its elasticity on the cellular tissue, which, as we have seen, is mixed up with the muscular. Its elasticity is inferior to its contractility; but its elasticity is indispensable. When the heart contracts, its muscular fibres have not only to expel the blood, but to overcome the elasticity which would prevent contraction; and when it dilates, the muscular fibres relax, and allow its elasticity to operate. The one is a vital, the other a mechanical

ing its combustion, which gives that brilliancy to the flame.

A candle may be compared to a small gas manufactory, where the gas is consumed as it is produced. The flame of a candle is produced by the oxygen of the air acting upon the outside of the formed gas; water and carbonic acid being produced by its combination. The flame of a candle is hollow, assuming the conical form, in order to be supplied with oxygen, as fig. 1. But if a heated wire be passed down the centre of the wick, and through the side, and then drawn out so as to leave a passage for the air, the flame will assume the form of fig. 2; it then being

Fig. 1. Fig. 2.



supplied with a current of oxygen on both sides of the flame. The following experiments prove that flame assumes the form of a hollow cone, when a current of air is not allowed to pass through it.

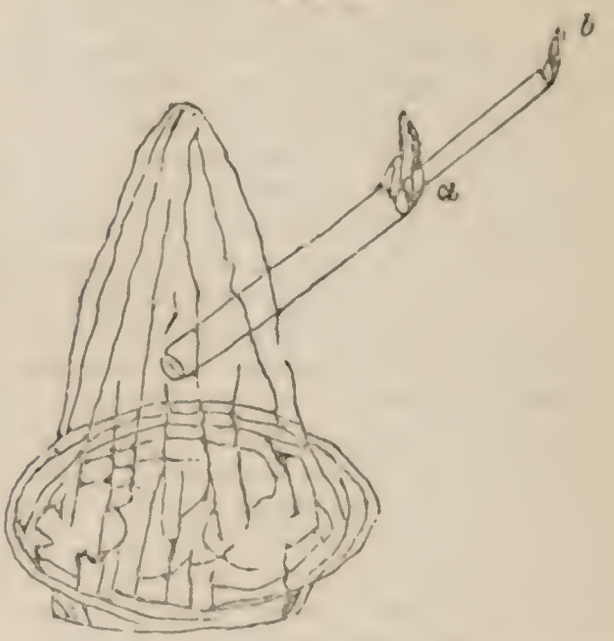
Exp. 1. Take a small plate, about two inches in breadth, and pour a little spirit of wine in it; upon setting fire to it, it will assume the conical form; take a piece of chip, and hold it through the centre of the flame, it will be found to burn only at the points, *a a*, fig. 3; the centre falling through.

Fig. 3.

Exp. 2. Place a piece of phosphorus in the centre, it will not be inflamed; in the same way sulphur, &c.

Exp. 3. If a glass tube be introduced within the flame of the burning spirit, in the manner represented in fig. 4, part of

Fig. 4.



the unconsumed vapour passes through, and may be kindled at *a*. The wider the tube the better; if the flame is sufficiently large, and a tube being thrust into the flame at *a*, the vapour may be also kindled at *b*. This experiment is best done with a large candle, and proves that the centre of a candle, lamp, &c., is filled with the unconsumed gas, which rises to be decomposed in its turn.

Felix Weiss.

Liverpool, Feb. 4.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 194.)

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agent. Power is created by the action of contractility, but elasticity merely restores a part to its primitive condition, when the constraining force has ceased to operate.

The cause of the heart's contraction is the entrance of the blood into its cavities; the cause of the heart's dilatation is the action of its elasticity when its contractility has ceased. In this manner may be explained what have been called the *systole*, or contraction, and the *diastole*, or dilatation of this organ. The elastic power facilitates the reception of the blood into the heart; the contractile power effects its departure from it. The elastic power opens the auricle; the contractile power closes the ventricle. When the contents of the auricle have been expelled, as soon as the contractile power has so relaxed as to give the elastic power the superiority, dilatation commences, and proceeds until the walls of the auricle have resumed their natural state. A vacuum is, therefore, formed within the auricle, and the blood which is urged forwards to the heart along the veins, is invited by this vacuum into the auricle. Elasticity and contractility are, then, two great powers by which the heart acts.

Supposing that the quantity of blood taken into the heart during each dilatation be two ounces and a half, that the heart contracts seventy-five times in a minute, and that thirty pounds represent the quantity of blood circulating in the body of a moderately-sized man, the whole mass of blood will pass through the heart twenty-three times every hour, and an entire circulation will be performed every three minutes. The time spent during one circulation may thus be easily ascertained; but it is more difficult to discover how far the action of the heart extends along the arteries, and at what rate the blood travels in different stages of its journey."

With these remarks I may conclude the lecture. I intended to have said a few words on the proofs of the circulation, and the circumstances attending its discovery; but I have probably engaged you long enough for the present. I trust, however, that the subject has been interesting, and that I have proved the statement with which I commenced, namely, that there was nothing in it that could be in any way unpleasing; but, on the contrary, it engaged the mind in contemplating contrivances the most beautiful that can be conceived, and suggested reflections of the greatest moment and importance to us all. Under the impression that you may probably desire to pursue the subject farther, I shall take the liberty of naming a few popular works, with which I think you will not fail to be pleased. First, I would recommend Dr. Southwood Smith's "Philosophy of Health," and his "Treatise on Animal Physiology" in the "Library of Useful Knowledge." Mr. Lord's work, "Popular Physiology," published by the Society for the Promotion of Christian Knowledge, is also a useful book; and Dr. Andrew Coombe's Treatises on "The Principles of Physiology applied to the Preservation of Health and on Digestion," having been written expressly for popular use, will likewise be acceptable. In addition to these, I would likewise particularly recommend the perusal of "Paley's Natural Theology," a pleasing work of instruction, and containing profound reflections on the knowledge that may be gained from the books previously mentioned.

ON THE METALS.

(From Hope's "Practical Chemist.")

GENERAL PROPERTIES OF METALS.

METALS are distinguished from all other bodies by the following properties:—

1. They are all conductors of heat and electricity.

2. They are quite opaque, though reduced to very thin leaves.*

3. They are good reflectors of light, exhibiting a peculiar appearance, called the metallic lustre.

4. When combinations of these, with any of the preceding elements, are subjected to the action of the galvanic battery, the metals are separated at the negative pole of the battery. Every substance possessing these properties is regarded as a metal.

The number of metals recognised by chemists is forty-one.†

Some metals are malleable, or are capable of being hammered or rolled out into thin sheets or leaves, such as sheet iron, lead and copper, gold and silver leaf, and tin foil. Gold possesses this property in a higher degree than any other metal.

Some metals are *ductile*, or capable of being drawn into wires; for which gold, silver, iron, and copper, are remarkable.

The relative *weight* of the metals is very

* The greenish light seen when gold leaf is held before a candle, is supposed to be owing to the passage of the light through exceedingly small apertures in the metal.

† By some chemists, silicon is regarded as a metal, in which case the number would be forty-two.

different. Gold and platinum are more than nineteen times heavier than water, while potassium is so light as to float upon its surface.

Tenacity or strength. Iron is the most tenacious of all the metals; a wire about the size of a man's finger, will support a weight of 50,000 lbs.

Metals have considerable affinity for other bodies; hence they are rarely found *native* or pure. Silver, gold, platinum, copper, and a few others, are frequently found in a pure state, though most metals are obtained from the earth in the state of an *ore*, which generally consists of the metal combined with oxygen or sulphur, forming an *oxide* or *sulphuret*. The most usual method of separation of the metal from the oxygen, or sulphur, consists in heating the ore, either in open air, or in contact with charcoal, which separates the impurities, and exhibits the metal in a pure state. This process is called the *reduction* of the metal.

The metals unite with each other, and form a class of compounds called *alloys*, which are exceedingly useful in the arts. Brass is an alloy of copper and zinc; pewter, of tin and lead; and bell metal an alloy of copper and tin, or of copper, tin, and zinc.

Amalgams are combinations of the metals with quicksilver. Some of these are very useful in the arts: thus, an amalgam of quicksilver and tin is used to cover the backs of looking-glasses; and of quicksilver and gold, for gilding buttons and various other articles.

The classification of metals which will be adopted in this work, is founded, in part, on the nature of their oxides, and in part on their practical applications. The first two chapters are founded on the first principle, and the last three on the latter.

The metals will be divided into five classes, the first of which includes those metals whose oxides have alkaline properties, and are hence denominated alkaline metals; the second, those whose oxides form earths, and which will be called earthy metals; the third includes the cheaper and more common kinds of those metals that are used in the arts; the fourth, the more perfect metals of the same kind, and which are generally of great value; the fifth class includes those metals that have not yet been applied to the purposes of art.

ALKALINE METALS, AND THEIR COMBINATIONS WITH THE PRECEDING BODIES.

Potassium, Sodium, Lithium, Barium, Strontium, Calcium, and Magnesium.

*Potassium.**—Potassium was discovered by Sir Humphrey Davy in 1807, by placing a piece of pure potash between the poles of a powerful galvanic battery. A large quantity of oxygen was liberated at the positive pole, and globules of high metallic lustre, resembling quicksilver, appeared at the negative. The metal obtained in this manner was in very small quantities; but another method was soon adopted by Messrs. Gay Lussac and Thenard, of France, by which they obtained it in much greater quantities, by heating iron turnings in contact with pure potash, which is an oxide of the metal.

Properties.—Potassium is a white metal, resembling quicksilver, having the whiteness of tin; it is so soft that it may readily be kneaded with the fingers, and is considerably lighter than water. With a fresh surface it has strong metallic lustre, but is instantly tarnished by exposure to air, exhibiting at first a bluish cast, like that of a recently-cut surface of lead, and is afterwards covered with a white crust, which is pure potash.

Potassium has a powerful affinity for oxygen, and will take it from any other compound that contains it.

Illust.—When thrown upon water it decomposes that liquid, moving over its surface with rapidity, and combining with both its constituents with the phenomenon of combustion, accompanied by a beautiful rose-coloured flame. The oxygen of the water combines with a part of the metal, forming an oxide (potash) which is dissolved in the water, while the hydrogen takes up another portion of the metal, forming a gaseous compound called *potassiuretted hydrogen*, which inflames spontaneously when it comes in contact with the air, and burns with a rose-coloured flame as before mentioned.

Oxides of Potassium.—There are two combinations of potassium with oxygen, the *protoxide* or potassa, which is composed of 1 atom of each ingredient, and the peroxide, composed of 1 atom metal to 3 of oxygen.

POTASSA.—*Potash.*—48.

Potassa is a white crystalline solid, and is only obtained in a state of purity by

* The figures after the names of metals in the titles, represent their combining number, or equivalent.

burning the metal in oxygen gas or in air; but for ordinary purposes it is procured from woodashes, which contain the potassa in combination with carbonic acid; which last being separated, the potassa is left pure, with the exception of containing 1 atom of water, which cannot be removed short of reducing the potassium to a metallic state. The article, therefore, as thus obtained, is properly called a *hydrate* of potassa. When exposed to the air, it absorbs water from it, and becomes liquid; this property is called *deliquescence*.

Obs.—The name of potassa is now generally applied to the pure article and to the hydrate, while the term *potash* is retained for that which is procured by boiling to dryness the ley obtained by *leeching* or lixivating woodashes, and is frequently called common or crude potash. It was formerly called vegetable alkali. The name potash was given because the ley was boiled down in pots.

Potassa is called alkali, as it changes vegetable blues to green. It is called fixed alkali to distinguish it from ammonia, which is called volatile alkali. It combines with acids, forming salts. Pearlash is, in chemical language, carbonate of potassa.

SODIUM—24.

Sodium is the metallic base of common salt, and was discovered by Sir Humphrey Davy, a few days after his discovery of potassium, and by means of the same instrument. The experiment was in all respects performed in the same manner, except that the alkali soda was substituted for potassa.

Sodium may be obtained from soda, charcoal, and iron turnings, in the same manner as potassium. Thirteen ounces of soda yield about one ounce of the metal.

Sodium is a white metal resembling potassium. It is a little heavier than that metal, but light enough to float on water, and moves about upon its surface with a hissing noise, and rapidly combines with its constituents, forming soda and sodiuretted hydrogen.

Illust. When sodium is thrown upon water, its oxygen combines with a part of the metal, forming soda, which is dissolved in the liquid, its hydrogen, at the same time, taking up another portion of the metal, forms a gaseous compound, analogous to potassiuretted hydrogen; the proper name of this new compound is *sodiuretted hydrogen*.

Sodium fuses at 200 degrees, and is vapourized at a white heat; it is so soft that it may be easily pressed out into leaves by means of a knife. It is immediately tarnished on exposure to the air, from the combination with its oxygen; but is not so rapidly oxydized as potassium.

When a small piece of sodium is placed upon clean quicksilver, it soon begins to move if the surface be moistened, as by breathing on it; the motion is somewhat irregular, but generally circular, and the whole surface of the quicksilver becomes agitated, presenting a very singular appearance. If a small piece of sodium be brought in contact with a globule of quicksilver, and the two be pressed together, as with a clean pair of forceps, or the blade of a knife, they will unite by a kind of explosion, and the steel knife or forceps will be amalgamated.

Sodium combines with oxygen in two proportions, forming two oxides. The first, or *protoxide*, is more generally called *soda*; it is also called one of the mineral alkalies, and is composed of 1 atom of sodium and 1 of oxygen. *Peroxide* of sodium is a yellowish solid, composed of 2 atoms of sodium to 3 of oxygen, and is formed when the metal is burnt in pure oxygen gas.

SODA—32.

Soda is a greyish-white solid, and is formed when the metal is burnt in oxygen or air; it is also formed when the metal is thrown upon water, by uniting with its oxygen; but in whatever way procured, except by uniting the metal with dry oxygen, it retains a portion of water which cannot be separated by any means hitherto employed. It is therefore called *hydrate* of soda.

Soda is extensively used in the arts. It is sometimes called the *mineral alkali*. It is very soluble in water, absorbs water from the air, or *deliquesces*. It changes vegetable blues to green.

Soda was formerly prepared from the ashes of seaweed, which is called *kelp*, or from those of plants growing in the vicinity of the sea (called *baril'a*). More recently it has been prepared by the decomposition of Glauber's salt, mixed with sawdust at a high heat.

Soda is extensively used in soap making, and constitutes the base of all hard soaps, while potash forms the base of soft soaps. The Castile soap is made of soda and sweet oil. Common brown bar soap is made of a mixture of potash and soda with tallow, and contains much rosin. That which has a marbled or mottled appearance derives it from the copperas or iron rust used, both of which injure the article. Transparent soaps, used extensively for the toilet, are prepared by dis-

solving the soap in spirits of wine, by means of heat, and as the liquid cools, a transparent and solid cake is formed at the bottom. The soaps are scented by adding essential oils before they become solid.

Sodium combines with chlorine, forming a *chloride* of sodium; this is the well-known article, common salt.

Sodium combines with hydrogen, and forms *sodiuretted hydrogen*. This compound is formed in great abundance in the experiment for obtaining sodium, and when sodium is oxydized by means of water.

Properties. Sodiuretted hydrogen is a colourless gas, slightly absorbed by water. It is a non-supporter of combustion; it is very inflammable, burning with a brilliant yellow flame, in air or in oxygen, producing soda and water. The gas is decomposed in a few honrs by standing over water or quicksilver. When standing over water, 30 measures of the gas are reduced to 29, producing pure hydrogen and soda, which last is dissolved in the liquid. When confined over quicksilver, an amalgam of sodium and pure hydrogen are the products.

LITHIUM—10.

Lithium is the metallic base of the alkali called *lithia*, discovered in 1818, and is contained in some minerals, such as some varieties of mica or mineral isinglass. Lithia is an alkali, composed of 10 parts, or 1 atom of lithium, and 8, or 1 atom of oxygen.

BARIUM—69.

Barium is a white metal, somewhat resembling cast iron, and is the metallic base of the alkaline earth, called *barytes*, *baryta*. It was discovered by Sir Humphrey Davy in 1807.

Baryta is an oxide of Barium, and composed of 1 atom of each element. It is a white solid, possessing alkaline properties, and when water is poured on it, slakes like common quicklime, giving out considerable heat. It combines with acids, forming salts.

STRONTIUM—44.

Strontium is the metallic base which forms, by its union with oxygen, an alkaline mineral called *strontia;* this received its name from Strontian, a small village in Scotland, where it was discovered in a lead mine. This mineral is also found on an island in Lake Erie, called Strontian Island. Strontia gives a blood-red colour to spirits of wine, whence it is used in theatrical representations to exhibit the red lights required on such occasions.

Exp. Pulverize some nitrate of strontia, and thoroughly moisten it with alcohol; place it on a tile or brick and set fire to it; the alcohol will be tinged of a blood-red.

CALCIUM—20.

Calcium is the name given to the metallic base of lime. It is a white metal like silver, and was discovered by Sir Humphrey Davy in 1807; though lime, which is an oxide of this metal, has been known from the remotest ages.

LIME—28.

Lime is composed of 1 atom of calcium united to 1 of oxygen; its equivalent is therefore (20 + 8) 28.

Lime is a greyish-white, brittle, earthy solid, the specific gravity of which is about 2.3. It is called *quicklime*, formerly *calcareous earth.*

Lime is never found native, but is generally combined with some acid, and that is most frequently the carbonic. The limestone, so common in the form of marble quarries and chalk hills (as in England) are all a carbonate of lime, from which lime is prepared by heat.

Illust. Lime is prepared by heating marble or common limestone to redness in kilns, by which process the carbonic acid is expelled and quicklime is left.

Lime has a great affinity for water, and the combination is attended with the production of much heat, and a formation of a white bulky powder called the *hydrate* of lime, and is composed of 1 equivalent of lime and 1 of water. This process is called *slakeing* of lime, and the substance itself is called *slaked* lime.

Obs. 1. The heat given out, where large quantities of lime are slaked at once, is sufficient to set fire to tinder, and in some instances light has been seen. The heat produced is owing to the condensation of the water to the solid state. Lime exposed to the air, soon absorbs sufficient moisture to form a hydrate; it is then said to be *air slaked.* If we continue to add more water to lime that has been slaked, a thick cream-like liquid is formed, called *cream of lime*, which is used for white-washing the walls of buildings. By far the largest proportion of lime is used for mortar, in laying brick and stone for building.

2. Chalk and marble are carbonates of lime; plaster of Paris, or gypsum, is the sulphate; and animal bones are a mix-

ture of the phosphate and carbonate of lime.

CHLORIDE OF LIME.

This compound, known under the name of *bleaching powder*, or chloride of lime, is prepared by exposing recently slaked lime, on stone shelves in a close room, to the action of chlorine gas. Large quantities of the gas combine directly with the lime.

Chloride of lime is a dry white powder, having a faint odour of chlorine, and an acrid and disagreeable taste; it partially dissolves in water, and has powerful bleaching properties.

Obs. 1. Nearly all the bleached cotton and linen goods are prepared by the chloride of lime. The goods are first cleansed by washing them out in hot pearlash water, to remove all dirt and grease, and then immersed in a solution of the chloride, and afterwards washed in more pearlash water. Both of these processes are repeated until the goods become sufficiently white, when they are boiled in a diluted solution of pearlash and white soap, which removes all odour of chlorine, and gives to the articles a clear and beautiful whiteness.

2. Chloride of lime is also used for the purpose of disinfection when contagious diseases prevail. It is considerably used in medicine.

Exp. 1. To a solution of indigo dissolved in sulphuric acid, pour in a solution of chloride of lime, the colour will disappear.

2. Repeat the same experiment with solution of blue cabbage.

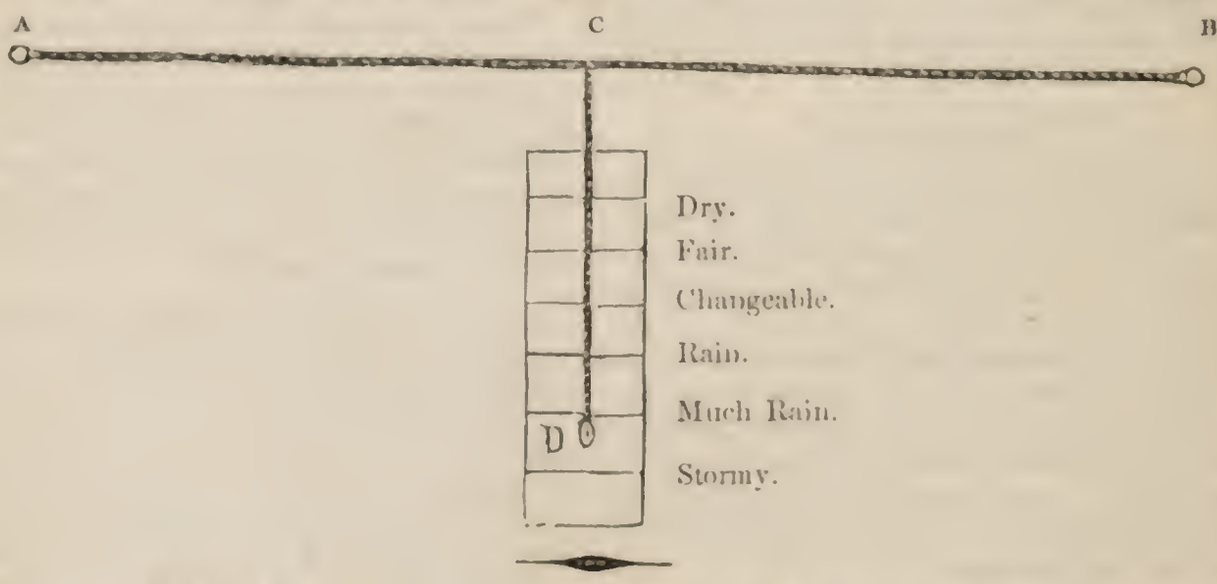
3. Take a piece of blue cotton goods, and immerse it in a boiling solution of chloride of lime, the colour will disappear.

4. Shave off exceedingly thin films of the unbleached bees-wax, and throw them into the solution of chloride of lime —they will be bleached in a few minutes.

SIMPLE METHOD OF MAKING A BAROMETER OR HYGROMETER.

TAKE a piece of whipcord, about two feet long, and steep it in a strong solution of salt; then tie a knot at each end, and on two nails, A and B, fix the same to any wall; if an outside one, the better. From centre, C, suspend, by a silken thread, a leaden plummet, about the thickness of a tobacco-pipe, and an inch long; then affix a piece of card paper against the wall, marking thereon the highest and lowest range of the plummet for very dry and stormy, and the intermediate spaces into degrees. A hygrometer of this kind will be found to correspond with the rise and fall of the mercurial barometer.

S. RUTTER.



REVIEW.

The People's Letter-bag, and Penny Postage Act Companion; containing Forms of Letters written on every-day subjects, and adapted to the use of the Million. By WILLIAM WAVERTON. Darton and Clark.

WHOEVER for the small charge of one shilling drops his hand into the "People's Letter-bag," may draw letters upon every variety of subject, so as to put it out of the power of either man, woman, or child, who can use his pen, to plead as an excuse for not communicating with absent friends, that they "do not know what to write." We cordially recommend it to everyone who may be at a loss to express his ideas.

SOLUTION OF PROBLEM.

To the Editor of the Mechanic and Chemist.

Sir,—May I beg you to insert in your valuable miscellany, the following solution of the problem proposed in No. 68.

Given $(x+1)\,.\,(x^2+1)\,.\,(x^3+1)=30\,x^3$.

Multiplying, we have $x^6+x^5+x^4-28\,x^3+x^2+x+1=0$;

And this is divisible into factors $x^2-3\,x+1=0$.

The first solved gives $x=(3\pm\sqrt{5})\div 2$. The latter is also solvable by quadratics, for it is equal to $(x+1)^4=-6\,x^2$; or, $(x+1)^2\pm x\sqrt{(-6)}$.

Hence $x=\pm\sqrt{(-6-2)}\pm\sqrt{(-6\pm 4\sqrt{-6})}$.

I remain yours respectfully,

J. Yates,
8th Batt. Roy. Artil.

ANOTHER SOLUTION OF THE CLOCK QUESTION.

Put $x=$ the number of minute spaces traversed by the hour hand; then $12\,x=$ ditto passed over by the minute hand. Then by the question,

$x+15=12\,x$; or, $11\,x=15\;\therefore\;x=1\frac{4}{11}$ min. $=1$ min. $21\frac{9}{11}$ sec. for the position of the minute hands.

W. W.

[With unaffected deference to our much-esteemed correspondent, we cannot admit this as "another solution" of the question, but consider it identical in principle with the third method we suggested, i. e., the same conclusions are obtained from the same data; but for *obvious reasons* we avoided even the *appearance* of abstruseness in our explanation.—Ed.]

HYDROSTATICAL QUESTION.

Sir,—I have worked out my former question as follows:—

$8^3\times .5236=268.0832$ cubic inches in the ball, divided by $2=134.0416$ cubic inches to be immersed.

Then $134.0416\times .578$, weight of a cubic inch of water $=77.4760448$ ounces, weight of water displaced, or the weight of the copper ball; which divide by 5.159, the weight of a cubic inch of copper $=15.0176$ cubic inches of copper in the ball.

Again, $8^2\times .7854\times 4=202.0624$ square inches the superficies of the ball; and 15.0176 divided by $202.0624=.0743$ inches, the required thickness of the copper.

A. D. M.

MECHANICAL AND CHEMICAL SOCIETY.

It is particularly requested, that all persons residing in London, willing to join, or help in the formation of a "London Mechanical and Chemical Society," will forward their addresses by post to "Tyro Chemicus," Essex and Temple Coffee-house, 43, Essex Street, Strand, where they will meet with immediate attention; and if sufficient, a meeting will be called, and other preliminaries arranged, relative to the immediate establishment of the Society. No letters will be taken in unless post paid. Communicating as early as possible will oblige

Tyro Chemicus.

Feb. 4, 1840.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Feb. 19, R. H. Semple, Esq., on the Alkalies. Friday, Feb. 21, H. Brown, on the Spirit of Burlesque, as exhibited in English Literature. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 20, N. F. Zaba, Esq., on the History of Poland. At half-past eight.

Poplar Institution, East India Road.—Tuesday, Feb. 18, R. O. Ogilvie, Esq., on Electricity. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, Feb. 18, Henry Althans, Esq., on Mental Discipline. At eight o'clock.

QUERIES.

A cheap plan for making either a theodolite, or a quadrant? LOGARITHON.

How to make bath bricks for cleaning knives &c, and what they are composed of?

J. H. H.

Suppose a large capitalist lends a sum of 1000*l*, upon the terms that it shall be returned within 52 weeks, by equal weekly instalments, and that *upon advancing* the 1000*l*, he deducts the 52 weeks' interest at five per cent (50*l*); this 50*l*, he lends again to another party upon precisely similar terms, and also lends upon the same terms the weekly instalments of the 950*l* remainder of the 1000 as they come in; and so on; lending always the sums produced by the interest retained, and the weekly instalments as they come in *to other parties*, upon the exact terms, upon which *the original borrowers* had them. The question is, how much profit would the capitalist derive *yearly*, from his 1000*l*; supposing there to be no bad debts, and that the money was always invested? GAMMA.

ANSWERS TO QUERIES.

To make Fulminating Silver.—"R. H. H." Dissolve pure silver in nitric acid, and precipitate the silver by lime-water; put the precipitate upon filtering paper, and when dry, put it into a shallow vessel (it is better not to remove it from the filtering paper); then pour liquid ammonia upon it, and when it has stood a few hours, pour off the liquid, and a black powder remains, which must be carefully set in a proper place to dry. It is better to dilute the solution of silver, and add the lime-water as long as any precipitate is thrown down. This is the mode of making fulminating silver. A very little friction or a gentle heat causes a violent explosion. It must not be put into bottles, but left in the vessel in which it is made; care being taken not to operate upon any quantity. The compound that is generally used, and which will answer all the purposes of "R. H. H," is called detonating silver, and is thus prepared;—Dissolve 60 grains of silver in ½oz. of nitric acid, adding 2 ounces of spirits of wine. The solution must be heated till it begins to boil; a copious precipitate is obtained, which, when washed and dried, is ready for use. It explodes by heat, a blow, or long continued friction, but not by pressure. Fulminating mercury answers most of the purposes of fulminating silver; but it is not so powerful, and will bear a greater friction without detonating, and the report is about the same as that of silver. It is prepared thus:—Take 100 hundred grains of mercury, and dissolve it in a measured 1½oz. of nitric acid with heat; when cold pour upon it 2 measured ounces of alcohol, and apply heat till effervescence is produced; a white fume will then begin to appear on the surface of the liquor, and a powder will be gradually precipitated. Collect on a filter, wash and dry it cautiously. FELIX WEISS.

TO CORRESPONDENTS.

Frederick Clark.—*We feel great pleasure in observing the progress of the Mechanical and Chemical Society proposed by "Tyro Chemicus," and we confidently predict brilliant success to the united exertions of our worthy friends. The handsome and liberal offer contained in the following letter, will, we trust, be doubly prized; it will be valued for the accommodation itself, and more especially for the alliance of the writer:—*

To the Editor of the Mechanic and Chemist.

Sir,—I am desirous of becoming a member of the Society about to be formed by "Tyro Chemicus;" and as I think there would be more societies formed, were it not for the want of meeting places unattended with expense, as is the case with coffee-houses, &c., I beg to offer "Tyro Chemicus" and his friends (if not already suited) the use of a room to hold their meetings, until such time as the Society can make arrangements, to have a more convenient one of their own.

I remain, Sir, your obedient servant,

FREDRICK CLARK.

37, Sussex Street, Tottenham Court Road.

Sigma.—*We shall be glad to receive the papers he proposes to send.*

S. K.—*To make looking-glass, the quicksilver must be spread on the tin foil, and a piece of writing-paper placed upon the silvered surface; then apply the glass, and draw out the paper, pressing at the same time upon the glass. The whole process should be as rapidly performed as possible, and a weight placed on the glass till the silver appears fixed, that is, till the process of amalgamation is finished. The method of cleaning and polishing shells was described in a recent number of "The Mechanic."*

C. S. *would greatly oblige "Felix Weiss," by sending him a letter, stating the price and dimensions of his microscope. Direct, 53, Pembroke Place, Liverpool.*

J. B.—*The number of vibrations which a pendulum makes in a given time, varies as the square-root of its length. The length of a pendulum which vibrates seconds in this latitude, is 39.2 inches; and, consequently, the length of a pendulum which vibrates half seconds, or 120 times in a minute, is ¼ of 39.2, or 9.8 inches, and a pendulum vibrating double seconds, or 30 times in a minute, is four times 39.2, or 156.8 inches.*

M. T. N. *proposes a mode of conveying letters to different parts of the metropolis by means of locomotive engines running in tunnels; the advantages derived from such a scheme would not be commensurate with the enormous expense it would occasion. A similar plan was in contemplation some years ago, but intended for the conveyance of gas, water, sewers, &c., as well as for passengers; it was, however, abandoned for the reason above stated.*

S. Walter *in our next, if possible.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

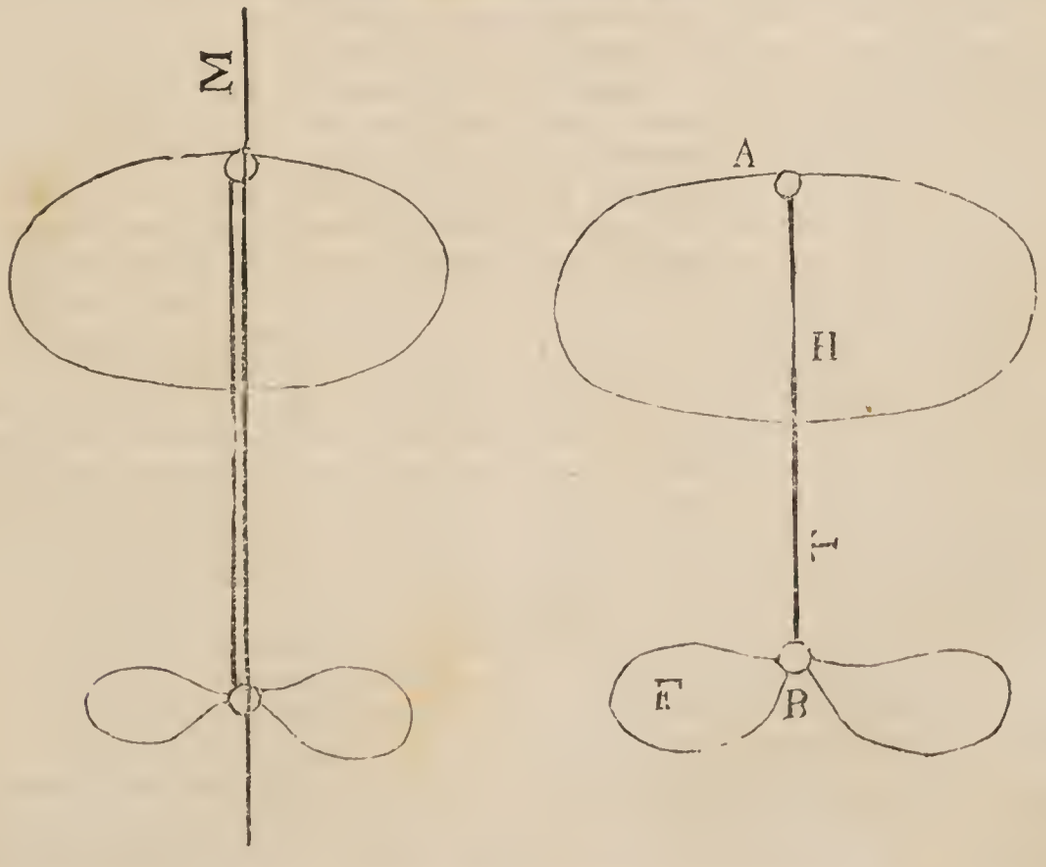
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 78, NEW SERIES. } SATURDAY, FEB. 22, 1840. PRICE ONE PENNY. { No. 199, OLD SERIES.

HODGE'S FIRE-ESCAPE.



VOL. V.—No. 29.] City Press, 1, Long Lane, Aldersgate Street; D. A. Doudney.

HODGE'S FIRE-ESCAPE.

(See Engraving, front page.)

This simple and cheap contrivance consists of a few pieces of cordage. The first piece, called the main-supporter, should be in thickness from three-fourths of an inch to one inch in diameter, a bulk sufficiently great to bear the weight of anyone; and as to its length, that will depend upon the height of the lodger's room, where the rope is to be securely fastened to one end of a bedstead, coiled up, and examined occasionally, to see that the fastenings, as well as cordage, are both in a secure state.

The next piece, called the shoulder-holder, must be in proportion with the body it is to surround; say half an inch in diameter, but something more for a heavy person; and from four feet and a half to six feet in length, with an eye in the midst, to slide over the main supporter.

The third piece, called the feet-holder, has also an eye to slide; but that piece is divided into two parts, in order that both feet may be supported; and one or the other, risen up occasionally to expedite the journey downwards. As to the fourth piece, called the tye, it is designed to keep the shoulder and feet-holders together, by fastening the ends to both eyes, as A and B; a view without the main-supporter.

Thus, all appendages being fixed upon the main-supporter, fastened securely, and coiled up. the shoulder-holder is then to be first thrown over the body, before throwing the remainder of the rope out of a window; and, after getting out, place the feet in their holders, which being done, the act of sliding downwards may be gradually or hastily performed, by keeping the eye of the shoulder-piece more or less horizontally, and moving one foot or the other upwards, to do the like with the eye of the feet-holder; which, I think, would be most proper if manufactured of iron, and wound over with a string, after first fixing both ends of the cord around the hollow of the iron eye.

Some farther reservation seems, however, wanting for the aged and weak; such as surrounding the shoulder-holder as far as the armpits with wool, cotton, or something else of a soft nature, to hinder the rope from grating the skin. A string for drawing both sides together, as an additional security in keeping the rope under the armpits, may also be added; and although it is certain that the act of sliding can be performed gradually, a pair of gloves for tender hands cannot be amiss.

As throwing over the shoulder-piece, getting out of the window, and sliding down, may be all performed in four or five minutes, the rope could then be soon returned to another person in the same room, in the event that the progress of the flames shall not have advanced so far as to hinder a retreat; and for this reason I would advise, that a variety of fire-escapes may be manufactured with two and even three pairs of holders on one main-supporter; so that that person who is to descend first, will have to use the last holder, or that one farthest removed from the first point of safety; and supposing that the flames shall destroy that point, there will then be only the farther expense of splicing a piece; but if the main-supporter shall be designed for a second or third floor, it could then be exchanged, at a very trifling loss, for another to suit the original height.

ADVICE TO TRAVELLERS.

(From a very clever and amusing Work, "The Letter-bag of the Great Western.")

"Call steward, inquire the number of your cabin; he will tell you No. 1, perhaps. Ah, very true, steward; here is half a sovereign to begin with; don't forget *it is* No. 1. This is the beginning of the voyage; I shall not forget the end of it. He never does lose sight of No. 1, and you continue to be No. 1 ever after;—best dish at dinner, by accident, is always placed before you, best attendance behind you, and so on.—*I always do this.*

If you are to have a chum, take a young one, and you can have your own way by breaking him yourself.—*I always do.*

If the berths are over each other, let the young fellow climb, and do you take the lowest one; it is better he should break his neck than you.—*I always do.*

All the luggage not required for immediate use is marked 'below.' Don't mark yours at all, and you have it all in your own cabin, where you know where to find it when you want it. It is not then squeezed to death by a hundred tons of trunks. If you have not room in your cabin for it all, hint to your young chum he has too much baggage, and some of it must go 'below.'—*I always do.*

Never speak to a child, or you can't get clear of the nasty little lap dog thing ever afterwards.—*I never do.*

Always judge your fellow-passengers to be the opposite of what they strive to appear to be. For instance, a military man

is not quarrelsome, for no man doubts his courage; a snob is. A clergyman is not over strait-laced, for his piety is not questioned; but a cheat is. A lawyer is not apt to be argumentative; but an actor is. A woman that is all smiles and graces is a vixen at heart; snakes fascinate. A stranger that is obsequious and over civil without apparent cause, is treacherous; cats that purr are apt to bite and scratch. Pride is one thing, assumption is another; the latter must always get the cold shoulder, for whoever shows it is no gentleman; men never affect to be what they are, but what they are not. The only man who really is what he appears to be, *is*—a gentleman.—*I always judge thus.*

Keep no money in your pockets; when your clothes are brushed in the morning, it is apt—ahem—to fall out.—*I never do.*

At table see what wine the captain drinks; it is not the worst.—*I always do.*

Never discuss religion or politics with those who hold opinions opposite to yours; they are subjects that heat in handling until they burn your fingers. Never talk learnedly on topics you know, it makes people afraid of you. Never talk on subjects you don't know, it makes people despise you. Never argue, no man is worth the trouble of convincing; and the better you reason, the more obstinate people become. Never pun on a man's words, it is as bad as spitting in his face; in short, whenever practicable, let others perform, and do you look on. A seat in the dress-circle is preferable to a part in the play.—*This is my rule.*

Be always civil, and no one will wish to be rude to you; be ceremonious, and people cannot if they would. Impertinence seldom honours you with a visit without an invitation—at least—*I always find it so.*

Never play at cards. Some people know too little for your temper, and others too much for your pocket.—*I never do.*"

CURIOUS ANCIENT RECEIPTS.

We present the following to our readers, rather as hints for future experiments, than methods to be practised exactly as described. Brass may be coloured to resemble gold, by immersing the articles in nitric acid for about one second, and then instantly plunging them in clean water; improved methods of producing some of the other effects may at present be known; but they appear on the whole to possess sufficient originality to attract the attention of the curious.

1. *To Harden Tin, and render it as Shining as Silver.*—Mix lead and tin with Greek pitch, and then take a lump of potter's clay, make a hole in it, and pour your mixture into it; then take of fine tin six or more ounces, and that being thoroughly melted, pour it on the mixture in the remaining space of the hole, before the mixture is cold; then leaving a hole in that, by thrusting an iron through it, pour in an ounce of mercury, which penetrating the whole mass, it will render the tin, when wrought and burnished, of the perfect lustre of silver; insomuch, that vessels made of it, will not by the eye be distinguishable the one from the other.

2. *To make Brass in colour resemble Gold.*—Bruise sal armoniac in a brass mortar into fine powder, mingle it with fasting spittle, till it becomes liquid, or like an ointment, and with this composition anoint your brass things; then hold them over a charcoal fire till the brass becomes pretty hot; then rub it over with whiting and bran well dried, and you will perceive it look like burnished gold, which will cause much admiration in those that know not what has been done unto it.

3. *To Clean Silver or other fine Metals.*—Take whiting and burned alum, mix them with the ashes of burned wheaten straw, and, when finely beaten, rub the plate, &c., with a woollen cloth well dried and heated against the fire, and your expectations will be curiously answered.

4. *To restore the Faded Colour in Cloth.*—Take woodashes, one part, quicklime, two parts, and put them into a lye made pretty strong with woodashes finely drawn off, and cleared from the settlings; then boil your cloth in a copper vessel with them, and rinse it out in warm water, wherein a lump of alum has been dissolved; press it, and it will look glossy, and of a fine new colour.

5. *To make Iron look as if Gilded with Gold.*—Burn an ounce of roch alum till it looks of a reddish colour, then take of sal armoniac an ounce, and of nitre half an ounce; beat them to a fine powder, and put them into boiling strong vinegar, in a brass pan, or other brass vessel, and when the liquor is a third part consumed, strain it well, and rub over smooth iron with it, and it will appear as if it were gilt with gold.

6. *A Varnish for Wood or Metal, representing a Golden Colour.*—Take two ounces of gum sandarac, one ounce of litharge of gold, and four ounces of clarified linseed oil; boil them in a glazed earthen vessel, till they look of a transparent yellow, and, varnishing your materials with it according to art, they will appear as gilded.

7. *To make Porcelain, a curious way.*—

Take the glaire of eggs, and calcined egg-shells finely beaten to powder; put these beaten together into gum-arabic water; let them stand a while over embers and thicken, so that they may be made into pastils; and when you have moulded them into proper forms for your purpose, dry and harden them in the sun, and the work is finished.

8. *To Whiten Copper quite through the body of the Metal.*—Take such copper as kettles are usually made of, tough and pliable, lay the plates in a crucible, and between everyone of them a strewing of white arsenic finely powdered, and being melted, when the smoke is over, the copper will be as white as tin.

9. *To Melt Amber.*—Mix strong vinegar with the juice of citrons, one part of the latter to two of the former; into this put the amber, and, being set over a slow fire, you will find the amber melt or grow soft, so that you may turn or mould it like soft wax.

10. *To Whiten Pearls.*—If they turn yellow or spotted, so that they become unsightly, losing their native lustre, burn tartar to ashes, and make a lye of it with spring water, wherein a little alum has been dissolved, and, putting in the pearls, let them seeth over a stove fire, and it will restore the pristine whiteness as orient as ever, and render them more durable and weighty, so, consequently, better for use.

11. *To Soften or Dissolve Horn of any kind.*—Burn the pods of beans well dried to ashes, and make a lye of them, then draw off the liquid part from the dross, and put a third part of strong vinegar to it; add quicklime and tartar; boil them over a good fire, putting in your planchets or pieces of horn, and it will soon be soft to work or mould into any fashion, and, if long boiled, become a jellied substance; but the cool air will harden it again.

12. *To Soften Ivory and Whiten it.*—Distil strong white-wine vinegar three times, and decoct red sage leaves in it, with a little quicklime; the ivory, being put in when the liquor is boiling hot, will soon become soft, and much whiter than it was; also this will take out yellow stains from ivory, &c.

13. *To break a Bar of Iron with ease.*—Daub the part you would break over with melted soap, then run a thread round it, and draw it backwards and forwards several times, that it may make a crease in a narrow circle; then dip a sponge in aqua fortis, and clap it round the crease fast bound, for six hours; so when taken off, a little stroke will make the bar break in the place where the crease was, though as thick as a man's arm, to the admiration of those that know not what you have done to it before.

14. *To restore the Faded Colour in Tapestry or Turkey Carpets.*—When you have beaten them, and with a hard brush cleansed them well with water in which bran hath been boiled, rub them over with fuller's earth, and let it lie thinly on, till well dried in the sun, and so do twice or thrice; and then being well cleansed from this by a thorough beating, brush them well over with alum water, and dry them in the shade, and so the faded colour will return almost as fresh as new.

HYDRAULIC LETTER-BALANCE.

(See Engraving opposite page.)

DESCRIPTION.—The stand, *a a*, furnished with two projecting rings, *b b*, to support the glass tubes, *c d*; *c* is a tube with mercury, to serve as a counterpoise; the tube, *d*, is closed at the lower end, and furnished with a wood cap, *e*, to receive letters.

This balance acts in the following manner:—When a weight is placed on *e*, the tube, *d*, sinks in the mercury, causing it to rise in proportion to the difference in the diameter of the two tubes, and to the weight employed. Farther explanation is unnecessary.

A. Z.

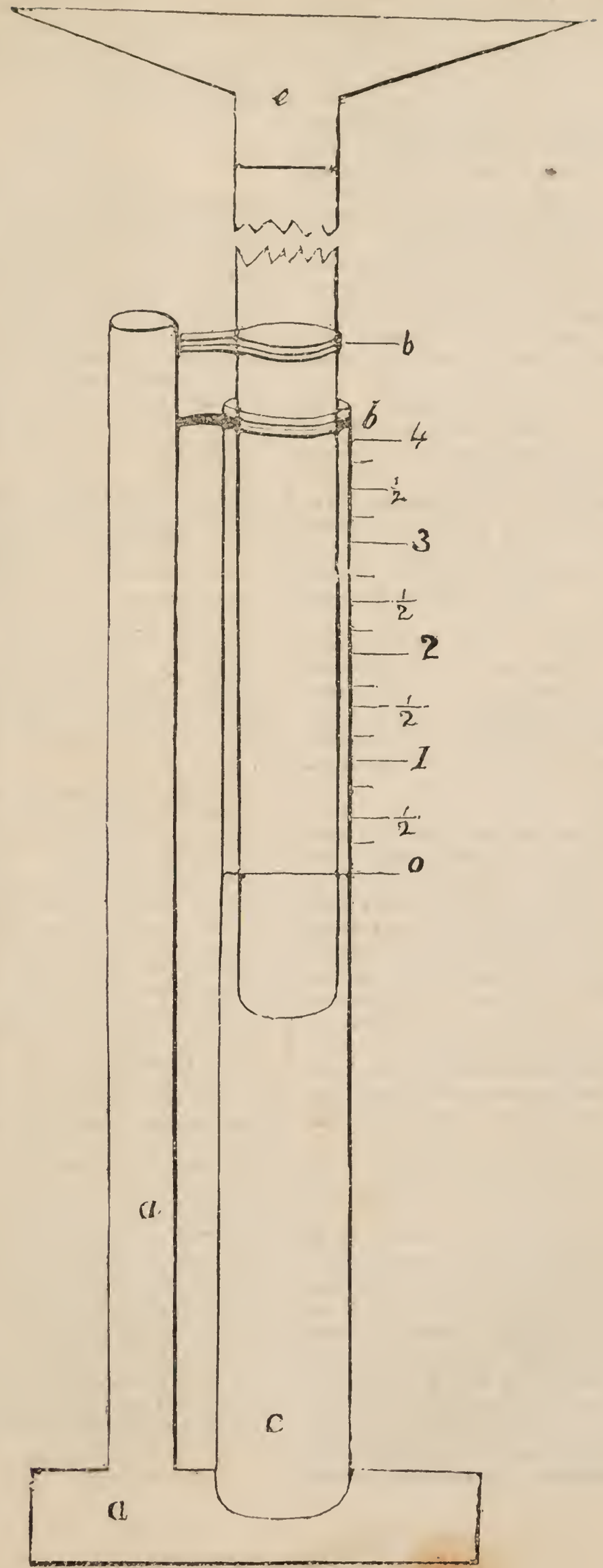
Brighton.

ON ALKALIES.

INTRODUCTION.

THE alkalies are a class of chemical compounds, chiefly distinguished by their solubility in water; their power of changing the purple colour of infusion of red cabbage and radishes to a green, the reddened tincture of litmus to a purple, and the yellow colour of turmeric to a brown, and their power of neutralizing acids. The alkalies are a class of bodies which have properties the reverse of acids; they are considered as diametrically opposed to each other in their nature. An alkali has a peculiar taste, quite different to an acid; but, like them, is often caustic and poisonous. When, therefore, an alkali and an acid are mixed, we might naturally expect to have a compound doubly pernicious; but the reverse is the case. A familiar instance of this I may mention, that is, in

SIMPLE AND ELEGANT HYDRAULIC LETTER-BALANCE.



the composition of common salt. This salt may be obtained by the mixture of two very corrosive substances. i. e., muriatic acid and soda; they combine and neutralize each other, producing the mild and agreeable table salt, termed by chemists chloride of sodium. The alkalies of most importance in the arts and manufactures, are, potassa, soda, ammonia, and quina. The three former are likewise of great utility to the chemical philosopher. Chemists divide the alkalies into three classes, viz., the mineral (or those that have a metal for their base), the volatile (or that one that is exceedingly apt to assume the gaseous form), and the vegetable (or those that are never found in any other substance than of vegetable origin). The term alkali is of Arabian origin, and signifies the "dregs of bitterness." As an abridged sketch of the alkalies will appear in this periodical, it will be necessary to use the contractions; thus, V., Vegeto, prefixed to each alkali to denote its nature. They will be arranged in alphabetical order. I shall, therefore, begin with

Aconita (Vegeto).—This alkali is procured from the aconite, and is probably contained in several species of that plant. It is extremely poisonous. Its peculiar properties and combinations are but slightly known, and it has not yet been analysed.

Ammonia (V.)—This alkali in its purest state, is in the form of a gas, highly pungent, possessing all the mechanical properties of air; but is very condensable in water, that liquid being capable of taking up 460 times its bulk; this is then called liquid ammonia. For chemical experiments, it may be obtained by heating in a retort one part of sal ammoniac (muriate of ammonia), with two of quicklime, or by boiling the liquid ammonia. It must be collected in the mercurio-pneumatic trough, in consequence of its immediate condensation by water. Ammonia is composed of

Hydrogen .. 3	condensed	2	82.53	=100
Nitrogen 1	into		17.47	

The base of ammonia is considered by Berzelius as a metal, which he terms *ammonium*; but his ideas as regards that substance are quite hypothetical, and are not generally adopted. Ammonia combines with the acids and forms neutral salts; the principal of which is the carbonate of ammonia, or smelling salts, and the muriate, or sal ammoniac. Ammoniacal gas extinguishes flame; but is itself partly combustible. A striking experiment may be performed, by conveying some carbonic acid gas into a jar containing ammoniacal gas; these two gases, when mixed, form a solid, which is carbonate of ammonia.

G. Pitsse.

MISCELLANEA.

There is an instance hitherto unnoticed in the annals of English industry, where an article is raised in price by the manufacturer, from one halfpenny to the amount of 35,000 guineas! This occurs in the making of watch springs. A pound of crude iron costs one halfpenny; it is converted into steel; that steel into watch springs, every one of which is sold for half a guinea, and weighs only one-tenth of a grain. After deducting for waste, there are in a pound weight 7000 grains; it therefore affords steel for 70,000 watch springs, the value of which, at half a guinea each, is 35,000 guineas!

Pollen, the powder-like substance observed in flowers. From experiments made upon it by eminent chemists, it is found to differ on analysis in different plants. The pollen of the date is said to possess in its composition a likeness to animal substances. That of the hazel-nut flower may be said to have partly the nature of barks, tannin, resin, gluten, and fibrin entering into its composition. That of the tulip consists of much vegetable albumen, a little malate of lime, malic acid, malate of magnesia, saltpetre, and malate of ammonia. Malates are salts composed of malic acid (which is acid of apples) with different alkalies.

Wm. V——e.

Strength of Materials.—Coulumb found that the force of torsion is equally powerful in wires, annealed and unannealed: they performed their vibrations in equal times. A tempered bar required also as much force to deflect it to a given angle as a hard one of the same dimensions. A soft bar, a spring tempered, and a hard one, were bent to equal angles by five pounds; with six the hard bar broke; with seven the soft one bent, but returned as far from its new position, upon the removal of the weight, as if it had not bent. The elastic bar was broken by 18 pounds.

Novel Illumination.—The beautiful and intense light produced by the combustion of lime, was applied on Monday last to the purpose of illuminating the turrets of Vanburgh Castle, the residence of L. H. Potts, Esq., situated at the eastern entrance to Greenwich Park on the top of Maze Hill. We understand that this, which is generally known as the Drummond light, will be renewed at nine o'clock every Monday evening of her Majesty's honeymoon, with various modifications, and directed towards London; so that our readers may contrast the intensity and penetrating power of different varieties of light. The effect of two lights used on this occasion, which were placed at some distance one above the other, was extremely brilliant and splendid; and although the moon shone brightly, the lights were discernible at a considerable distance.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Feb. 26, W. H. J. Traice, Esq., on Shakspeare's Comedy of "As you Like it." Friday, Feb. 28, Election of Officers. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 27, N. F. Zaba, Esq., on the History of Poland. At eight o'clock.

Poplar Institution, East India Road.—Tuesday, Feb. 25, T. Lewin, Esq., on Capital Punishment. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, Feb. 25, J. Mitchell, Esq., L. L. D., F. G. S., on Volcanoes. At eight o'clock.

QUERIES.

Can any of your numerous correspondents inform me how the following equation can be solved in the form of a pure quadratic?

Given $\left\{\begin{matrix} x+y=a \\ x^3-y^3=b \end{matrix}\right\}$ to find x and y?

E. Cooper.

What will take the stains of wood out of mahogany? W. J. C.

1. Which is the most durable in the open air, zinc or lead? 2. Where can I purchase patterns, such as carvers use? 3. The cheapest work on mathematical calculation concerning harmonics?

C. G. Sidey.

The best method of keeping a common-place book; that is, under what heads should the subjects be arranged? Also, the best modern system of short-hand? J. P.

The best materials for polishing small garnets? I have tried diamond powder, but it is too sharp; it is also very expensive. I believe rotten-stone is used for that purpose, but I do not know how to apply it in the proper manner. I also wish to know of a cement (if there be one) better adapted to small work than shell-lac?

An Amateur Jeweller.

A description of the most superior lathe in general use, with the over-hand motions, &c., for working the engine-work on watches, nobs of parasols, &c.? Also, the most useful numbers for a dividing-plate, the pulley being only four inches in diameter? J. Nicklin.

Having been in the habit of making oxygen gas for particular purposes from the chlorate of potash, in order to have it pure, and this salt being very expensive, insomuch as to preclude many from using it; I shall feel myself personally obliged if any of your numerous correspondents would inform me of a simple method of making the salt alluded to. I understand that it can be procured by passing a stream of chlorine gas through a solution of potash; but if anyone could give me a description of the small apparatus requisite and the quantities employed, it would confer a great favour on

George Cooper.

1. Where can I purchase a bellows and blowpipe on a small scale for blowing glass tubes, &c.? 2. What is the scale for cutting the glass for the different notes for a harmonicon?

H. B. N.

What weight will be required to counterpoise a float of stone 4½ inches in thickness, 16 diameter, and immersed two-thirds of its thickness in fresh water? A. D. M.

1. How to make printing ink? 2. How to render soap transparent? 3. How to polish steel and iron, and what is used to polish white metals, such as British metal &c.? S. K.

I should feel much obliged, if any of your correspondents would inform me from practical observation, if it be really the case, that, when the spiral end of the toy, denominated "Rapert's Drop" is broken, the rest explodes; if so, the cause. I have made them more than once, but they do not burst, although I have severed the tail in several different places.

A Young Experimentalist.

How to make essence of ginger, lemon, and peppermint? How to make cloth waterproof? How to clean kid gloves? G. R. C.

The most complete and expeditious system of short-hand? Would like to be informed what system it is which is usually practised in the Houses of Parliament? How to make cheap black and blue ink? Also, how to make good pomatum? R. T.

1. How to make the best quick drying spirit varnish, used by cabinet makers and carvers for varnishing their turned and carved work? 2. How to make the inside of a lead cylinder true, for a piston to work up and down, because I want to try an experiment with it? 3. What sand is generally used for casting metal in? 4. How to make and use birdlime? 5. How can I obtain skeletons of birds and small animals? 6. How can I preserve the skins for stuffing? 7. How can we distinguish the different gases separately, and from what are they obtained? 8. I should like to know whether there is any vessel fitting up with air machinery, because I heard there was; if so, where is it fitting up? W. S.

ANSWERS TO QUERIES.

To make Fulminating Silver.—"R. H. H." Dissolve one drachm of silver in half an ounce of strong nitric acid, then add by degrees two ounces of pure alcohol. The whole must now be heated very gradually in a Florence flask, until ebullition commences; a white flocculi will soon appear, at which time the heat must be taken away. The action will still continue, and the precipitate will increase in quantity. When the action ceases, and the mass is cooled, it must be thrown on a filter and washed several times with distilled water; the powder remaining on the filter must be allowed to get dry, and the operation is completed. Great care must be taken not to touch the powder hard, as the slightest friction is capable of causing an explosion, and sometimes when under water. It detonates with a very slight touch, or by an increase of temperature, or when touched with sulphuric acid. I

should not advise your correspondent to make a larger quantity than what I have stated, as it is very dangerous. To prevent accident, it is best to separate the powder into several parts, and wrap them up in separate papers. Fulminating mercury is very explosive, and detonates with a loud report, but not so much so as fulminating silver. A. Taylor.

Will of the Wisp.—"Mott." The gas which produces this singular appearance on stagnant pools, is hydouret of phosphorus, or phosphuretted hydrogen; it is formed in stagnant water, by the decomposition of vegetable and animal matter; it may however be produced by immersing a few pieces of phosphuret of calcium in water; the salt decomposes the water, the oxygen combining with the calcium, forming lime, while the hydrogen is disengaged, in combination with the phosphorus; it may be procured more easily, if the water used has a small quantity of hydrochloric acid mixed with it. Phosphuretted hydrogen, in its purest form is transparent, colourless, and not spontaneously inflammable at ordinary temperatures; but detonates with air, or oxygen, when heated to 300°, or when the electric spark is passed through it. If prepared with potash or lime, in the manner described above, it is at first disengaged spontaneously inflammable. If the pure gas be mixed, even with $\frac{1}{10,000}$ of nitrous acid, it inflames as soon as it comes in contact with atmospheric air.

A Young Experimentalist.

A correspondent, "Wm. V——e," may ascertain the exact precision of thermometer tubes, by blowing a bulb and introducing a short column of mercury into the stem, about an inch in length, which is accurately measured on a fine scale of equal parts in different portions of the tube, as the column is by the heat of the hand moved from the bulb to the open extremity of the tube. Should the mercurial column subtend the same number of divisions on the scale in every part of the tube, it may be considered as a perfect tube for a thermometer. H. B. N.

"Tyro Chemicus" may, I think, obtain the glass cylinders he speaks of, at Chaffin's glass warehouse, 69, Fleet Street.

J. Mitchell.

Cement for the Joints of Cast Iron.—"Sherwood's" inquiry for a cement for the joints of his cast-iron water cisterns having met my eye in the 70th Number of your valuable periodical, I believe the one below, which I have used for some time as a cement for the joints of soap pans, will suit him:—20 lbs. cast-iron borings; 2 oz. flour of sulphur; 1 oz. muriate of ammonia. The materials must be intimately mixed in the dry state, when a sufficient quantity of warm water must be added to render the whole quite wet; the mass is then pressed together in a lump, and allowed to remain till such time, when the combined action of the materials renders it quite hot, in which state it must be hammered with proper tools into the joints. I would like to be acquainted, through the medium of your valuable work, if, after trial, Sherwood finds the above to answer his purpose. W. G.

Liverpool.

"W. W." I beg to call your attention to a slight error which appeared in Nos. 76 and 77; it is this:—He says, "Put a piece of phosphuret of calcium, or phosphate of lime, into a glass of water," &c. Phosphate of lime would do no such thing as decompose water. Phosphuret of calcium, and *phosphate* of lime are totally different; the former is black, or nearly so, the latter white as driven snow. Phosphate of lime is the principal constituent of the bones of the human body. A pretty state we should be in, if our bones were to produce an inflammable gas by the addition of water. He is quite right as regards phosphuret of calcium.

G. W. S. Pierse.

In your last number, a correspondent asks for a cheap plan for making either a theodolite or quadrant. There is no cheap method of making either correctly, as the division of the degrees, &c., unless done by a proper machine, will cause every calculation to be false. I have at present by me an excellent quadrant, quite perfect, which I wish to dispose of at a cheap rate; and should your correspondent like to take it, I shall be happy to give him my information concerning the use of the instrument. I can also tell him of a cheap little book that would give him every information about it. S——.

9, Upper St. Martin's Lane, Long Acre.

TO CORRESPONDENTS.

W. J. C. *will see that the Mechanical and Chemical Society is in progress, and a place of meeting appointed and published in our last.*

P. T. J.—*The springs which produce a sound resembling a church bell, are formed by bending a long slender rod of steel in a spiral form, similar to the pendulum spring of a watch; they are attached at the outward extremity by a screw, and are small at each end, the thickest part being about the middle. When a particular note is required, they are tuned by reducing the outward extremity next to the screw, which lowers the tone; but if they should be too low, they may be raised by taking off a part of the end in the centre of the spiral. They should be hardened, and let down to about the temper of a watch spring (which is a pale blue, showing a dull red in the dark); but it must be observed, that the proper sound cannot be obtained without fixing them, or the plate to which they are attached, to a sufficiently large surface of wood, or some other material proper for conducting and developing sound. The springs in French repeating watches are made on this principle; but they produce little sound when not enclosed in the case. Their size must be proportional to the extent of the sonorous body to which they are attached; that is, the conducting body must be of sufficient dimensions; but no inconvenience will result from its exceeding those dimensions.*

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THE

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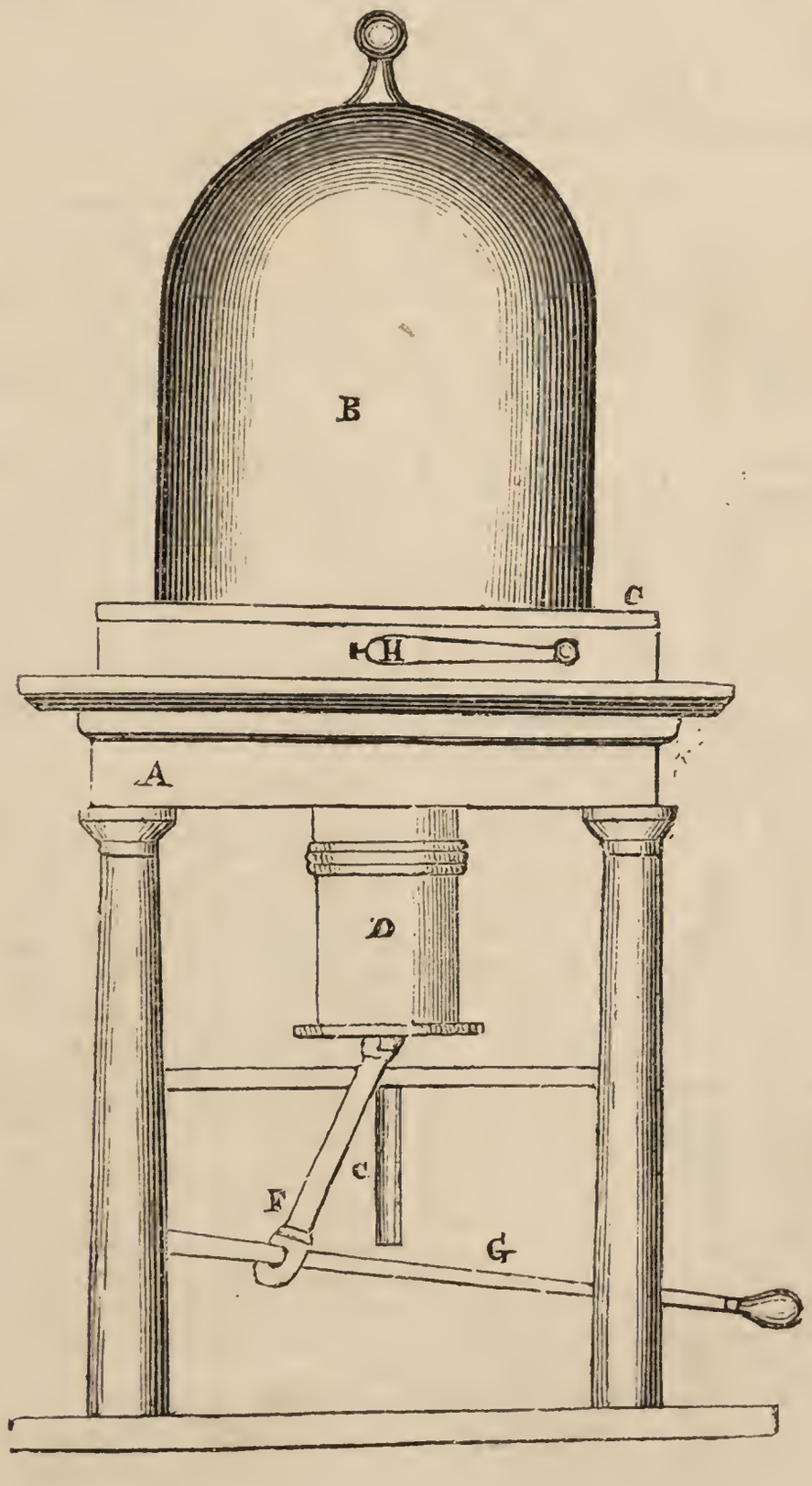
JOUGE'S AIR-PUMP.



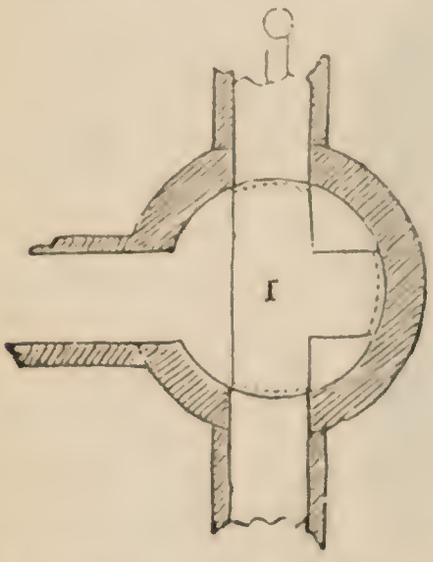
VOL. V.—No. 30] City Press, 1, Long Lane, Aldersgate Street : D. A. Boudney.

JOUGE'S AIR-PUMP.

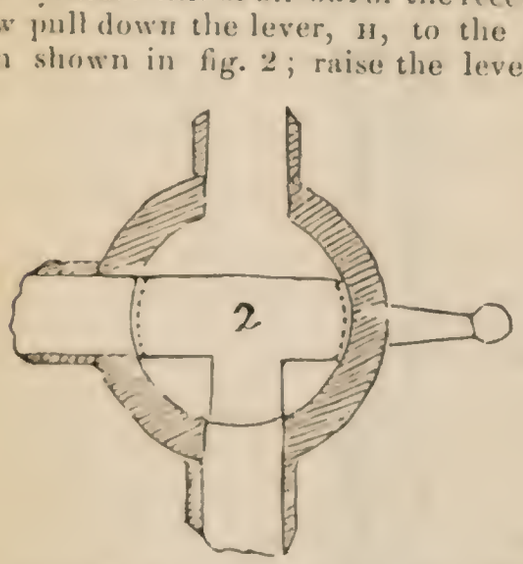
(See Engraving, front page.)

To the Editor of the Mechanic and Chemist

SIR,—I take this opportunity to send you a sketch of an air-pump, of the most simple construction that I am acquainted with. H is the frame; B, receiver; C, pump plate; D, cylinder; E, piston rod; F, connecting rod; G, lever to work the pump; A, lever to work the three-way cock. And now that you have got the description, you will want to know how it must be worked; this I will explain to you as plainly as I possibly can. Suppose you wished to exhaust the air out of the receiver, B, you must raise the lever, G, up to the top; then place the cock in the position shown in fig. 1; press down the lever, G, to the bot-



tom, and by that means you will exhaust one cylinder-full of air out of the receiver; now pull down the lever, H, to the position shown in fig. 2; raise the lever, G,



and you will force the air out of the cylinder; and by thus continuing to alter the position of the cock, and to raise and depress the piston, you will exhaust the air out of the receiver. But it often happens, when we are making experiments in pneumatics, that we wish to condense the air, and sometimes to a great degree; this an be done by a pump of the above description, without making any additions or alterations in the machine; and I will show you how:—Fasten the receiver on to the plate by any of the usual methods; press down the lever, G; place the cock in the position, fig. 1; raise the lever, G, and you will force a cylinder-full of air into the receiver; alter the position of the cock to fig. 2; press down the lever, G, and the air will rush into the cylinder, ready to be forced into the receiver. It is not necessary to form the frame in the manner shown in the sketch; but, as I am about to make one on that plan, I thought it would be as well to give you a view of the pump as it will stand when completed.

I remain yours, &c.,

CHARLES WM. JOUGE.

Manchester.

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 208.)

MAGNESIUM—12.

COMMON calcined magnesia is an oxide of a metal called magnesium. This metal was discovered by Sir Humphrey Davy, in 1807, by means of the galvanic battery; but in quantities too small to determine its properties. It was prepared by M. Bussy, a French chemist, in 1830, by heating small pieces of potassium in a platinum crucible with chloride of magnesium.

Rationale.—The chlorine leaves the magnesium and unites with the potassium, forming a chloride of potassium, and pure magnesium is left.

Magnesium is a white metal resembling silver, slightly malleable, and of a brilliant metallic lustre. It melts at a red heat, is slowly oxidized in moist air, but undergoes no change in dry air. When heated to redness in air or oxygen, it takes fire and burns with great brilliancy, forming magnesia.

MAGNESIA—20.

This compound is extensively used in medicine, and is prepared by heating the carbonate of magnesia until the carbonic acid is expelled. This process is called *calcining*, and the product, calcined *magnesia.*

Calcined magnesia is a white powder, extremely light, nearly insoluble in water, and when mixed with that liquid containing a solution of blue cabbage, the latter is changed to green, proving the alkaline nature of magnesia. It is composed of 1

atom of metal (12), and 1 of oxygen (8): its equivalent is therefore 20.

Magnesia forms a large portion of many common minerals, some of which are extensively used in the arts, such as soapstone, some kinds of marble, serpentine rock, asbestos, &c.

Obs.—Asbestos is the celebrated incombustible material; so flexible as to be spun and woven into cloth, of which garments have been made and exhibited as articles of great curiosity. These, when soiled, are cleansed by throwing them into the fire, which burns off the dirt, and thus the article is recovered, fresh and well cleansed.

EARTHY METALS AND THEIR COMBINATIONS WITH THE PRECEDING BODIES.

Aluminum, Glucinum, Yttrium, Thorinum, and Zirconium.

ALUMINUM.—14.

Aluminum is a white metal resembling silver, and is procured from the chloride by means of potassium, by a process similar to that for obtaining magnesium. When heated to redness, in air or pure oxygen, it takes fire and burns with great brilliancy, forming an oxide of this metal called *alumina* or *alumine*.

ALUMINA.—26.

Alumina is a compound of oxygen and aluminum, and is composed of 1 atom of metal (14), and 1½ of oxygen (12), its equivalent is therefore 26.

Alumina is one of the most abundant productions of nature. It is found in every region of the globe, under the name of clay, which is alumina in a greater or less degree of purity, and constitutes the chief material of which bricks, pipes, and earthenware are manufactured. It is also used in the preparation of common alum. Those clays which, when burnt, become red, contain oxide of iron, as seen in common bricks, which owe their colour to the presence of this substance. The ruby and sapphire, the oriental amethyst, emerald, and topaz, are nearly pure alumina, in a crystalline state.

Obs.—Materials used in Pottery.—Common brown earthenware is made of clay, which contains oxide of iron, giving it a reddish brown colour. This ware also contains considerable silica, which prevents it from cracking by sudden heat or cold.

2. White earthenware is made of very pure pipe-clay, that contains no iron; but silica forms a prominent ingredient, and if it be not contained in the clay, it is added by the manufacturer in the form of pure white sand.

3. *Porcelain*, called also chinaware, from its being first imported from that country, contains the same ingredients as white earthen, with the addition of a mineral called feldspar, which causes the ware to be translucent when baked.

4. *Manufacture of the Ware.*—The materials, mixed with water in sufficient quantity to form them into a very stiff paste, are moulded upon the potter's wheel, a very ancient instrument, mentioned by the earliest writers, both sacred and profane. A mass of the clay is placed in the centre of the wheel, during the revolution of which the material is moulded by the hands of the potter into the desired shape. If the articles are too thick, they are afterwards turned in a lathe to make them thinner. Handles, spouts, &c., are made separately, and put on afterwards by means of a thin paste of the clay.

5. *Baking of the Ware.*—The vessels are dried in the open air, or in stove rooms, and then exposed to a high heat in ovens for about two days; at the end of which, they are allowed to cool gradually, and are withdrawn from the ovens in a state of biscuit, as it is denominated by the workmen.

6. *Glazing.*—To prevent the absorption of liquids, and to preserve the cleanliness of the ware, it is covered with a thin film of vitreous or glassy matter called glazing, the composition of which differs in different kinds of ware. In common stoneware, which is made of clay only, the glazing consists of common salt. The operation is performed by throwing the salt into the furnaces or ovens when the ware is baking; the vapour of the salt, at a high heat, coming in contact with the vessels, partially vitrifies their outer surfaces, and gives a smooth and uniform covering. The inner surface contains no other glazing than the clay itself; hence this kind of ware is the best for preserving pickles, and other articles preserved in vinegar.

7. Common brown earthenware is glazed with a mixture of fine sand, white lead and common salt, ground very fine and mixed with water. The ware in the state of biscuit, is covered with this mixture, and then transferred to the ovens for melting on the glazing. This glazing is dangerous from the poisonous nature of the lead, which is dissolved by the acids contained in cider, wines, vinegar, &c.; hence articles containing acid should never be kept in brown earthen vessels. The glazing of the finer kinds of earthenware

contains the same ingredients as that of the brown ware, but in different proportions. That of the chinaware is composed entirely of the mineral feldspar, and is not acted upon by acids.

8. The blue colour is given to earthenware by an oxide of cobalt; green, by oxide of chromium. The lustre-ware, which has a bronze tint, is produced by an oxide of gold mixed with amber or red clay. The steel-coloured ware is produced by platinum, which is put on the ware after it is glazed; the metal is dissolved in nitro-muriatic acid,* and laid upon the ware, which is then put into the oven, exposed to a strong heat, and subsequently burnished. The gilded ware is covered with gold, by first dissolving that metal in nitro-muriatic acid, and the remainder of the process is conducted in the same manner as that described for platinum. The gilt-edged tea-sets, and other domestic articles, are prepared in this manner.

GLUCINUM.—18.

Glucinum is a very rare metal, of a feeble metallic lustre, the oxide of which is called *glucina*, and constitutes a considerable portion of the emerald and beryl. It has no uses in the arts.

YTTRIUM.—32.

Derives its name from Ytterby, a town in Sweden, where yttria, which is an oxide of this metal, was discovered. The salts of yttria are characterized by a sweet taste, as well as those of glucina.

THORINUM.—60.

Thorinum, or thorium, as it has sometimes been called, is a new metal, discovered about two years ago, by Berzelius, of Sweden, in a mineral called *thorite*, in which the metal exists in the state of an oxide, called *thorina*. Thorinum and all its compounds are exceedingly rare, and have not been used in the arts.

ZIRCONIUM.—30.

This metal, like the three last mentioned, is very rare. It was first obtained by Professor Berzelius, in 1824. Its oxide, called zirconia, is a pure earth, but exists only in a few rare minerals.

Obs.—The compounds of the four last elements that have been thus briefly described, have little to interest the pupil, and are therefore omitted.

* A mixture of nitric and muriatic acid, the only liquid that will dissolve gold or platinum.

LIFE ASSURANCE.

NO. I.

INTRODUCTION.

An apparent inducement has been held forth by some of the conductors of this magazine, for some farther remarks on the nature and principles of life assurance. A promise was also given by a writer in page 202, of a return to "the more pleasing task of examining some of the substantial, honourable, and benevolent institutions," which is now most cheerfully complied with.

But before advancing too far, it will be necessary to make some introductory observations upon this important subject, and to explain a few of the mystical bearings of the doctrine to such readers as have not hitherto devoted much attention to the subject. The writer would likewise remark, that some reference will be made in the future, in connexion with the present details, to his letter upon "Loan Societies" (page 202), and the plan there proposed; thus to afford the readers of this magazine at once a clear and succinct account of the most improved method of the day, for raising an immediate fund or future provision.

The theory of life assurance has been greatly improved within the last fifty years; it is mainly founded, as the reader will be pleased to notice, upon many facts connected with the mortality of human life. When it was discovered by the "bills of mortality," from even before the time of the great plague, that a usual number of deaths took place in several years, and that in the succeeding year a similar amount died, compared with the number then alive; it became a matter of expectancy with those who had made these observations, that out of every 10,000 alive the following year, a certain number might be expected to die. The first tables which we will merely notice of this kind, were formed by Halley, or De Moivre, from observations made in the town of Breslau, in the years 1687 and 1691; but as these tables are not much used, let us notice two other series of tables more particularly. The first of these was formed by Dr. Price, of Northampton, from the mortality of that town in the years 1741 and 1780, the number of male and female deaths being nearly equal. The following table will show the decrease of the number of 10,000 persons born, at every interval of five years, according to the Northampton tables:—

Age.	No. Living.	Decrement.
0	10,000	
5	5,356	4,644
10	4.864	492
15	4,648	216
20	4,399	249
25	4,080	319
30	3,759	321
35	3,437	322
40	3,116	321
45	2,784	332
50	2,449	335
&c.	&c.	&c.

Thus we find in the first column the age, say ten years; there are 4,864 living, and of this number 216 are expected to die before attaining the age of fifteen. These tables were, and are, at the present time, very extensively used by the assurance offices.

The next tables we will mention, are those of Mr. Milne, from the observations of Dr. Heysham, upon the mortality of the town of Carlisle in the years 1779 and 1787, and hence called the Carlisle tables. Mr. Milne has here shown, that life is to be considered more healthy than computed in the tables of Dr. Price; and, from the experience of the Equitable Society of London during the last fifty years, and the more enlightened state of society at the present day, there is every reason to believe so. Other tables of this kind have been constructed; but the two we have described are those more generally relied upon.

It will now be seen by the commonest observer, that there is great importance to be attached to the above statements, which have been tested by the experience of nearly a century. And it is quite as natural to suppose, that by an arithmetical operation, some information would arise as to the value of a sum of money at the expected death of an individual. Nor would it be presuming too much to say, that in the earliest stages of this theory of expectancy, some laws of probability might be made with a certain degree of success. For example, if 100 persons were, by the Northampton tables, to assure each others' lives; or, in other words, agree that at the time of death each should have 100*l.*; they could, without much difficulty, ascertain how long, by the above tables, they might expect to live, and, consequently, the necessary cost. Now, supposing each was aged forty, which would be a favourable coincidence; they might conclude that their average life would be about twenty-five years longer, or until they were aged sixty-five. But as this expression is by way of average, it will be necessary to remark, that about ten would be expected to die in the first five years; and, before the age of one hundred years, all would die, as follows:—

Age.	No. of Deaths.	
45	10.27	first five years.
50	10.36	next five years.
55	10.81	ditto.
60	10.84	ditto.
65	10.75	ditto.
70	10.66	ditto.
75	10.65	ditto.
80	9.84	ditto.
85	7.85	ditto.
90	4.66	ditto.
95	2.19	ditto.
100	1.69	ditto.
Total	100.	

Undoubtedly the preceding is mathematically incorrect, and only approximates nearly to the truth, supposing the tables perfectly true. Still it may be said the error is on the right side, and hence there would be gain to an office making such a calculation; but that must be explained hereafter.

The word *probability* has been used, and must now be explained. In the above estimate, it would be a great improbability, supposing some person was expected to live until 95, that 99 of the 100 would die aged 50. On the other hand, if 100 persons were each aged 40, it would be termed the highest degree of probability, that all those persons could not attain 90 years of age. This will explain the motive for viewing, what is commonly called chance, with the eye of probability; for, in mathematical reasoning, the word *certainty* cannot be here introduced.

Now before we advance farther in the explanation of this subject, which we propose to do systematically; it will be of the greatest importance, that the reader's mind should be free from that feeling called prejudice. For we would argue, from what has already been stated, that there is a great probability that the accounts of mortality handed down to us are nearly correct; and there is likewise a probability, that some society now existing was based upon right principles in its formation; or, rather, there is a very high degree of probability, that a line can be now drawn, to which the sum of former statements, and the experience of past

years, will converge in one point, resembling the truth.

If, then, these facts can be listened to attentively, and we intend to use technical phrases as little as possible, no doubt many will become persuaded of their importance who have hitherto deemed the subtle doctrine of life assurance, crude and fallacious.

SIGMA.

THE CHEMIST.

THE ELEMENTS AND THEIR COMBINATIONS.

(Continued from page 198.)

HYDROGEN has also been found to change the tone of the voice when inhaled; this effect is observed on the person speaking immediately after ceasing to breathe it, but it soon goes off. The flame of hydrogen is employed to produce intense heat when mixed with oxygen, and burnt as the mixture issues from a small jet. The flame of the mixed gases, when projected on lime, is also employed for the purpose of illumination, under the name of Drummond's light, and is also the same as the koniaphostic light lately exhibited at the Surrey Gardens.

Combinations of Hydrogen and Oxygen.—If two volumes of hydrogen and one of pure oxygen be ignited in a proper vessel by the electric spark, the gases will combine, and the interior of the vessel will be covered with pure water, equal in weight to the gases consumed. If pure water be exposed to the action of voltaic electricity, it is resolved into two volumes of hydrogen disengaged at the negative pole, and one volume of oxygen disengaged at the positive pole; so that water is proved, both by analysis and synthesis, to consist of two volumes of hydrogen and one of oxygen. The specific gravity of hydrogen compared with oxygen, is as 1 to 16, therefore the component parts of water by weight are,

1 Proportional of hydrogen	1
1 Ditto of oxygen	8
Equivalent of water	9

Or thus:—

Hydrogen	Oxygen	Water	Symbol H.
1	8	9	

For performing these experiments with accuracy, a delicacy of apparatus, as well as of manipulation, will be required, which the student can scarcely be expected to command. He may, however, satisfy himself of the truth of the doctrine by the following simple process:—Into a glass bottle adapt a cork, through which a small tube passes; introduce a small quantity of iron filings, and pour upon them diluted sulphuric acid. Inflame the hydrogen as it issues from the orifice of the tube, and hold an inverted jar over the flame. In a short time its interior surface will be covered with a very fine dew, which is pure water, produced from the combustion of the hydrogen gas and the oxygen of the atmosphere. The hydrogen should be allowed to pass off for some little time before it is inflamed, in order to drive the atmospheric air from the bottle, the presence of which might otherwise occasion explosion. Water, in its ordinary state, such as *spring* and *river* water is always so far contaminated with foreign substances, as to be unfit for many chemical purposes, and frequently even for domestic use. *Rain* water is much more pure; but it always contains a portion of carbonic acid, and of the elements of atmospheric air. The distinction of water into *hard* and *soft*, has reference to its less or greater purity. The impurities of water are separated by distillation. *Distilled* water, as commonly prepared, always affords minute traces of foreign matter, especially when subjected to the voltaic decomposition, and can only be considered as perfectly pure when redistilled at a low temperature in silver vessels. Pure water is without taste, smell, or colour. It is a powerful refractor of light, and a very imperfect conductor of heat and electricity. In consequence of the facility of obtaining it pure, it is assumed as a standard, to which the relative weight of all other bodies may be compared; its specific gravity being called = 1.000, and hence the importance of estimating its

weight with precision. At the temperature of 40°, it is at its maximum of density; and at that temperature an English cubic foot weighs 437102.4946 grains, or 999.0914161 ounces avoirdupois, and a cubic inch 252.953 grains. It is, therefore, about 828 times heavier than atmospheric air.

At the temperature of 32° water congeals into ice, which, if slowly formed, produces needles crossing each other at angles of 60° and 120°. Their forms are various; but the primitive figure has not been ascertained, though it is probably rhomboidal. The specific gravity of ice is 0.94, or thereabouts, varying a little in consequence of the air bubbles which it includes. The densest ice, however, obtained by freezing water deprived of air, is always lighter than water itself. In freezing, the water expands with such force, as to burst very thick and strong vessels in which it is confined. The most interesting experiments upon the subject, are those of Major Williams. Bomb-shells, about thirteen inches in diameter, and more than two inches thick, were filled with water; the fuse holes were then plugged with iron bolts, and, thus charged, were exposed to the open air, at a temperature between 4° and 19°. At the moment of congelation the plugs were thrown out, and the ice protruded through the fuse hole. When the plug was duly secured, the shell itself burst. The greatest difference observed in those experiments between the bulk of water before and after congelation, was : 174 : 184. If water be exposed to heat in open vessels, it boils, or is converted into steam at 212°, the barometer being at thirty inches; but the boiling point of water varies considerably with the pressure. At mean pressure and temperature of 212°, the bulk of steam is about 1700 times greater than that of water. Water is susceptible of compression, as was originally shown by Canton, and more lately by Mr. Perkins. He finds, that a pressure of 2000 atmospheres occasions a diminution of one-twelfth of its bulk. Water enters into combination with a variety of substances, and is retained with various degrees of force; where it contributes to the regular form and transparency of crystallized bodies: it is called the *water of crystallization*. In other cases, the compounds which water forms with substances, are termed hydrates; as with many of the metallic oxides; in both cases, it may be considered as one of the constituents of the bodies; for it exists in them in a definite proportion.

Water is a most general and useful solvent, especially of saline bodies, the relative solubilities of which will be stated under their individual chemical histories.

J. Mitchell.

(*To be continued.*)

MECHANICAL AND CHEMICAL SOCIETY.

It is particularly requested, that all persons residing in London, willing to join, or help in the formation of a "London Mechanical and Chemical Society," will forward their addresses by post to "Tyro Chemicus," Essex and Temple Coffee-house, 43, Essex Street, Strand, where they will meet with immediate attention; and if sufficient, a meeting will be called, and other preliminaries arranged, relative to the immediate establishment of the Society. No letters will be taken in unless post paid. Communicating as early as possible will oblige

Tyro Chemicus.

P. S. Tyro Chemicus presents his thanks for the numerous letters which he has received with assurances of support, and thinks that in a short time the Society will be established. Letters directed as above will oblige, and receive every attention. T. C.

Feb. 24, 1840.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, March 4, Quarterly Meeting, At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 5, the Rev. Dr. Vaughan, on Ancient Egypt. At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 3, J. Robinson, Esq., on Pneumatic Chemistry. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 3, W. H. J. Traice, Esq., on Shakspeare's Comedy of "As You Like It," with Illustrations. At eight o'clock.

QUERIES.

Sir,—Allow me to inquire, through the medium of your valuable work, the best method of transferring an engraving from paper on to wood, as we see them on small work-boxes, &c.? Also the best plan to turn a good sphere, being fond of turning for amusement, when my avocations will allow me time, having a large family to maintain. I have not the means of seeing these things as I might if I had more leisure; my business is quite in a different line, but am still fond of little things of this kind that are within my reach. I

have a very good foot lathe, with some little tackle about it, that have come out of my earnings, instead of being spent at the alehouses, which to me is a source of considerable pleasure, and some time or other you may, perhaps, give a description of a good eccentric chuck and slide rest. You will oblige me by giving, as early as convenient, the best method of burning hydrogen and oxygen on lime, and whether it is used as a light or not? B. O. J.

Ackrington.

[We deviate from our usual method, in inserting the above letter unabbreviated. We could not withhold from our readers so pleasing a picture of contentment and happiness in spite of fortune, and so striking a contrast with the misery which springs from the lawless and dangerous pursuits into which rash and misguided men are too often enticed by false friends. It is also an example of one of the many benefits which a poor man may derive from the general penny postage. Our worthy correspondent will find an answer to his last query in page 288 of the present number. To turn a sphere, it is only necessary to fix in the lathe a piece of the required material, cut into nearly the shape and size of the intended sphere, and strike a groove as near as possible in the middle of the block, and cut it down till it measures the diameter of the sphere required; then, by measurement, or trial in the lathe, form two centres on opposite sides of the groove, and turn off the projecting parts till the groove just disappears, and you will have a perfect sphere. This method, if correctly performed, is geometrically true; for a sphere is a figure formed by the revolution of a semicircle about its diameter, which is the principle upon which this operation is founded.—Ed.]

ANSWER TO QUERIES.

The Power of a Steam Engine is found thus:—Multiply the pressure of steam in the boiler in pounds per square inch, by the decimal .39, the product will be the effective pressure; then, multiply the number of square inches in the area of the cylinder by the effective pressure as above, that product by the number of feet the piston travels in a minute, and divide by 32,000; the quotient will be the power of the engine. Thus, an 8 inch cylinder is in area 50 square inches. Force of steam in the boiler

17½ lbs. × .39 = 6.8 lb. per square inch.

400
300

3400
220 feet per minute;

68
68

32000)7480(2.3 horses' power.
64000

10800
96000

12000

G. MITCHELL.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the* "MECHANIC AND CHEMIST" *is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half a Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half a Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press*, 1, *Long Lane, Aldersgate Street.*

G. Piesse *proposes the following singular question:—What would be the consequence if an* irresistable *body were to come in contact with an* immoveable *one? We are not disposed to deprive our talented correspondents of an opportunity of answering this question, but recommend them not to condemn it as foolish, since immobility and perfect hardness are frequently* supposed *to exist in separate bodies in mechanical problems. The fact which will be established by the proper consideration of this question, we shall not at present anticipate. His other query is answered, p.* 229.

H. B. N. *may see a table blowpipe, by applying to Mr. J. Day,* 12, *Whitfield Street, Leonard Street, Finsbury.*

X.Y. Z.—*We shall be happy to receive the paper he mentions.*

J. B. *requests that the date of his invention of a double-jetted blowpipe, a drawing and description of which we have received, should be recorded, which we accordingly do: it is Feb.* 22, 1840. *It will appear when the engraving is ready.*

D. L—y.—*We cannot perceive the utility of multiplying the forms and patterns of letter scales, without rendering the operation of weighing, either more rapid or more accurate than in the simplest construction of an ordinary scale. We have, however, a drawing at the engraver's of a very ingenious contrivance, which we expect will be pronounced far superior to any that have yet been presented to the public.*

Alex. Mills *has not propounded his question with sufficient precision to be intelligible. What does he mean by "a velocity equal to that in a circle at the same distance?"*

We must unavoidably defer till our next the notice of numerous communications.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

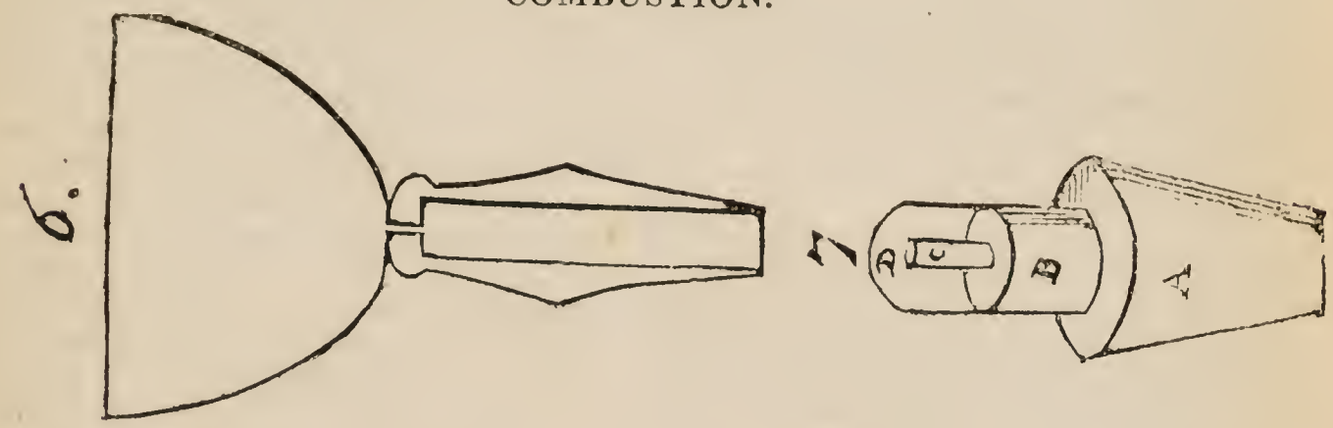
THE

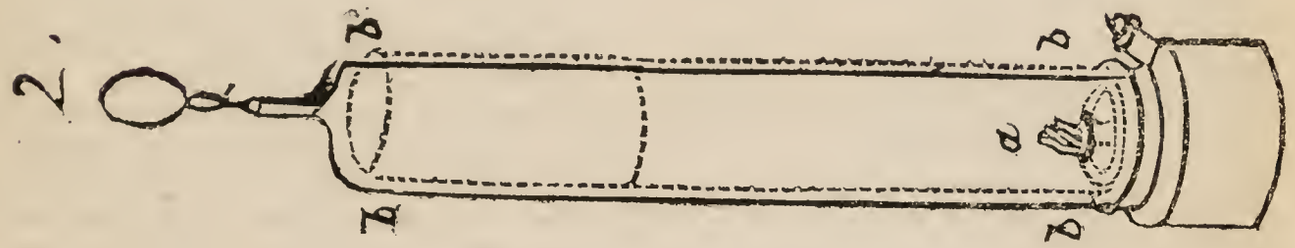
MECHANIC AND CHEMIST.

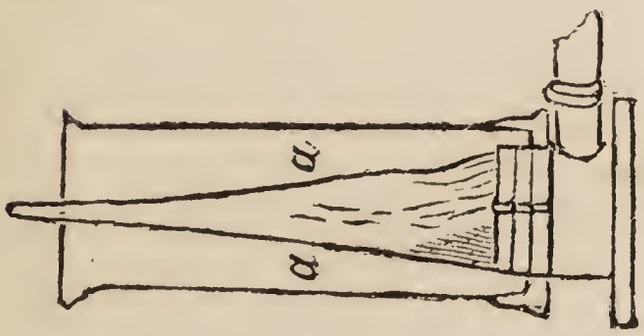
A MAGAZINE OF THE ARTS AND SCIENCES.

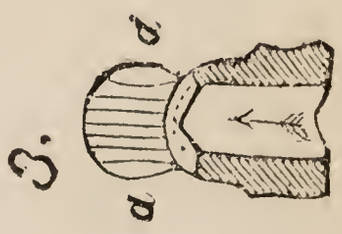
No. 80, NEW SERIES. } SATURDAY, MARCH 7, 1840. PRICE ONE PENNY. { No. 201, OLD SERIES.

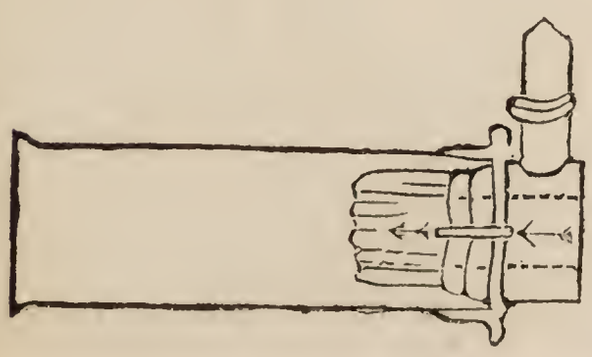
COMBUSTION.

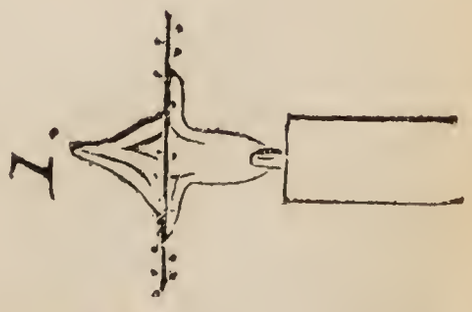












Vol. V.—No. 31.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

ON COMBUSTION.

(Continued from page 204.)

(See Engraving, front page.)

The nature of flame is beautifully illustrated by holding a piece of wire gauze, about 1000 meshes in the square inch, over the flame of a candle or a large stream of gas. The flame is intercepted, and appears only below the gauze; a tube or flame appearing expanded as it reaches it. The unconsumed gas rises through the gauze, and if a lighted match be applied, it burns on the upper side; the appearance is then presented as seen in fig. 1.

The solution of this is, simply, that flame will not exist without it is kept at the full white heat: therefore, when we hold the gauze over the candle, the flame, in trying to pass through, is cooled below the burning point. Upon this principle is constructed Sir Humphrey Davy's safety-lamp. In coal mines the atmosphere frequently becomes explosive, from the large quantity of bihyduret of carbon, the fire-damp of miners, which escapes from the coal as it is worked. A light would instantly detonate the mixture; but with this lamp, though the explosive mixture may enter within the gauze and burn there, the flame within cannot set fire to it without, so that the miner has time to escape. By the sudden glare of light, the miner is informed that such an explosive mixture is near. From what has been said, the construction of the safety-lamp will be easily understood. *a*, fig. 2, is a lamp surrounded with a tube of wire gauze, *b b b b*, supported by three iron rods, which also serve for the handle. The lamp is now generally surrounded with talk, in order to preserve it from sudden gusts of wind, which sometimes carry the flame through the gauze, endangering the safety of miners, and also a magnifying glass, which increases the light.

Lamps are now constructed, so as to allow a current of air to pass through the centre of the flame, to which are given the name of Argand burners. They are made to burn oil as well as gas; but I shall simply describe the gas Argand burner. It is formed of a circle of small jets, a section of which is seen at fig. 3; a current of air passing in the direction of the arrow. A full view is shown in fig. 4. In an Argand burner the intensity of the heat is augmented; so that more gas is consumed within a given space than in the ordinary manner. In fig. 3, it will be seen, that the surfaces of the burning gas, *a a*, *a a*, are very near, so that the interposed gas is heated much more than when these surfaces are distant. Much carbon, therefore, is precipitated, and becomes intensely luminous before it is consumed. If the aperture by which the air is admitted into the interior of the flame be closed, the flame represented in fig. 4 immediately assumes the form shown in fig. 5; part of the supply of air being cut off, it extends farther into the air before it meets with the oxygen necessary for its combustion. The heat is accordingly diffused over a larger surface, and becomes less intense; *a* and *a* are more distant from each other, a smaller quantity of carbon is deposited, less gas being decomposed; and even that which is separated, being less intensely heated, much of it is unconsumed, and produces a dingy and imperfect flame. A current of oxygen, instead of air, passed through the Argand burner, forms the Bude light. The most perfect form of burner is seen in the flat gas jet, fig. 6, where two opposing currents of gas meeting each other, flash into an extremely thin sheet of gas, which extends in an opposite direction to the currents which produce it. Here, the gas on one side being so extremely near that on the other, all the conditions are fulfilled which are necessary for intense heat and light. A very excellent gas burner is also described in No. 49, N. S., invented by Mr. Dockree.

With regard to oil lamps, there is very little variety in their construction, some having flat wicks, others round; but the best form is the circular wicks, allowing a current of air to pass through the centre, called the oil Argand lamp. Those used by chemists are called spirit lamps, and are made upon the same construction as those for oil. A very cheap and useful spirit lamp is made as follows:—Take a piece of glass tube about an inch and a half in length; make a hole through a small cork, and pass the tube through, till it projects at the upper end half an inch; then procure a short wide-mouthed bottle, and adapt a cork to it; perforate this cork also, and fit the smaller one into it in such manner, that the top of the one holding the tube may be about a third of an inch above the top of the other: the wick of the lamp is to pass through the tube and dip into the spirit below. To prevent the latter evaporating when the lamp is not in use, cut off the sealed end of a test tube, of such diameter that its inner surface may accurately receive and closely fit the small cork, and sufficiently long to cover the small tube and

wick. Press the whole firmly together, when the instrument is put aside; but the large cork must be loosened when it is burning, otherwise the spirit will not properly rise. In fig. 7, A represents the large cork; B, the small one fixed in it; C, the glass tube for the wick, and D, the end of the test tube, to prevent the evaporation of the spirit. I am still of an opinion, that lamps are far from being perfect, and I think it deserves more attention than is at present paid to it. I have long thought of the possibility of forming a wick which would not be consumed, so that it would require no snuffing, and would last for a length of time without any renewing. A few hints on this subject I must reserve for a future paper.

FELIX WEISS.

Liverpool.

(To be continued.)

ON LAND SURVEYING.

WITH regard to the origin of land surveying, historians differ very much in their opinions. Diodorus, Herodotus, and Strabo, attributed the invention of it to the Egyptians, whom they represent as constrained by the annual inundation of the Nile removing or defacing their landmarks, to devise some method of ascertaining the ancient boundaries after the waters had retired. By Josephus, however, it is ascribed to the Hebrews. According to him, the arts and sciences of Egypt were derived from the patriarch Abraham, who conveyed them into that country from the Chaldees.

Originally the science was called geometry; but this being deemed too comprehensive a title for the mensuration of superficies, it was afterwards denominated "the art of measuring land."

From the banks of the Nile it was carried into Greece by Thales, one of the seven wise men, born before Christ 640 years. This philosopher travelled into Egypt, and studied, under its sages, astronomy, geometry, and other branches of the mathematics; but having given offence to King Amasis, by the freedom of his remarks upon the conduct of princes, he returned home and employed himself in communicating the knowledge which he had acquired.

The great utility of land surveying, without which it is impossible to conduct the affairs of civilized life, induced many of the most celebrated philosophers and mathematicians of antiquity to study its principles; and to Thales, Pythagoras, Socrates, Plato, Aristotle, Euclid, Archimedes, &c., we are indebted for many substantial improvements. The ancient Romans likewise, it is said, held this art in such high veneration, that they accounted no man capable of commanding a legion, who was incapable of measuring a field.

But formerly, people not having the power to sell or alter their estates, any particular accuracy in land surveying was not required; but when they were permitted to do so, and land in consequence was daily changing owners, and also becoming more valuable; it became necessary to ascertain the area of each person's property with the greatest accuracy, and which has been fully accomplished by modern surveyors. It has also been carried to great perfection since the passing of the Tythe Commutation Act, which requires that surveyors of parishes shall deliver up their field books for the purpose of testing their work, and which has had the effect of showing who are good surveyors and who are not.

G. R.

EXPERIMENTS ON THE BAROMETER.

To the Editor of the Mechanic and Chemist.

SIR,—In a treatise which I lately read on the barometer, the author states, that at the level of the sea, the mean height of the mercury is the same all over the globe. He also states, that it was never known to fall lower than 28 inches in England. Am I to infer from this, that it sinks no lower than 28 inches in the far northern and southern regions.

Again, from my own observation I have found, that when the thermometer rises from the effect of heat, the barometer sinks in like proportion, and on the contrary. This to me seems mysterious, as it is a law, that all bodies expand by heat. A speedy insertion and solution of these queries in and by means of your valuable paper, will greatly oblige the writer.

J. B—N.

Birmingham.

[The variations in the pressure of the atmosphere, and, consequently, in the height of the mercury in the barometer, depend upon various causes: the greatest depression occurs in violent hurricanes, such as are experienced in the West Indies and other countries in or near the tropics. When the barometer indicates a great and sudden decrease of atmospheric

pressure under these circumstances, it is supposed that winds blowing in different directions from the same place, partially exhaust the incumbent column of air at that place; and this opinion seems to be corroborated by the rapid rise which follows, indicating the reflux of the surrounding air into the vacuum thus formed. It is also probable, that the tangential motion of the wind may have some effect in lessening the downward pressure; for it is, by the rectilinear force of its momentum, constantly endeavouring to quit the curved surface of the earth, and thus, to some extent, counteracting the gravity of the superincumbent column. The phenomenon of the barometer appearing to fall when the thermometer rises, is easily explained; in the thermometer, heat expands both the glass tube and the mercury within it; but the mercury increasing in bulk, more than the tube increases in capacity, the mercury is forced upwards; and the height of the mercury indicates the excess of its expansion above that of the tube. In the barometer, the same expansions take place; but the mercury not being confined, flows down into the reservoir below, and the atmospheric pressure still sustains its equivalent column of mercury—something higher, indeed, than before the expansion, because its specific gravity is thereby diminished, but less than the expansion of the glass, which, being increased in length, makes the mercury, which occupies a less proportion thereof, appear to descend. This, however, is so small a quantity as not to be easily perceived; and we suspect, that the effect observed by our correspondent, was the result of some imperfection in his instrument. If any portion of air should be contained in the tube above the mercury, the expansion of that air would produce the effect described. To discover whether there is any air in the tube, it must be reversed, and if there is, a bubble will be seen at the end of the tube.—Ed.]

ON ALKALIES.

(Continued from page 220.)

Aricina (Vegeto).—This was discovered by Cerial in 1829, in a bark which had been used to adulterate cinchona. It much resembles cinchona in its outward character, but differs in its chemical qualities. When pure, it is nearly tasteless; but, when dissolved in acids, is extremely bitter. It is decomposed by concentrated nitric acid, and, with it, produces a green colour; but, when the acid is very dilute, a colourless nitrate is obtained. According to the analysis of Pelletier, it is composed of

Carbon	70.9
Oxygen	13.9
Hydrogen	6.9
Nitrogen	8.3
	100.0

Atropia (Vegeto.)—This alkali exists in the plant called the deadly nightshade. It is obtained from the root after it has been dried, which yields only one-three-thousandth of the pure alkali. It is soluble in ether and anhydrous alcohol, and in 500 parts of water. It forms definite compounds with acids, which are decomposed by potassa and ammonia; when heated with potassa, it is decomposed, and yields ammonia. According to Dr. Liebeg, it is composed of

Carbon	68
Hydrogen	26
Oxygen	12
Nitrogen	1
	107.

Baryta or Baryles (Earthy).—This alkaline earth is the oxide of barium. It consists of

Barium	89.7
Oxygen	10.3
	100.0

To obtain pure baryta, take the native carbonate and reduce it to a powder; then dissolve it in nitric acid (diluted), and evaporate the solution till crystals be formed; then calcine them in a China or platina crucible, for at least an hour, at a dull red heat; then suffer the vessel to cool, and transfer the whole of the contents into a stopped bottle. This is pure baryta; it is of a bluish colour; fusible only at the jet of the oxyhydrogen blowpipe; has a sharp caustic taste; corrodes the tongue, and all animal matter; is exceedingly poisonous; has a very powerful alkaline reaction. Its specific gravity is 4.0. When sprinkled with water it becomes hot, and slakes violently, falling into a fine white powder, called the hydrate of baryta, which contains 10½ per cent. of water. Baryta unites with phosphorus, which compound decomposes water rapidly; it also combines with sulphur. Baryta is soluble in twenty times its weight of cold water, and twice its weight of boiling. It may be crystallized. Of all the bases, baryta has the strongest affinity for sulphuric acid, and hence it is employed as a

test for that acid. The only use of this alkaline earth in commerce, is to adulterate white lead; the dealers use the sulphate of baryta or heavy spar.

G. Piesse.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 92.)

Towcester is a market town in Northamptonshire, about five miles and a half west of the railway. It was a fortified town of considerable strength in the time of the Saxons, and resisted for a long time the attacks of the Danes; but it seems to have been ultimately overpowered, for in the year 921, King Edward issued a mandate ordering Towcester to be rebuilt and fortified. In Doomsday Book, the name of this place is spelt *Tovecestre*, which signifies a fortified city on the river Tove. It is situated on the ancient Roman way called Watling Street; and, from the number of Roman coins which have been dug up in the neighbourhood, it has been supposed by some antiquarians, that the Roman station called Lactodoro was on this spot; but others contend that it was at Stoney Stratford, which is also on the Watling Street. Towcester, as at present existing, consists principally of one long and spacious street. The church, dedicated to St. Lawrence, is a neat erection of the eleventh century; it contains a monument erected to the memory of Archdeacon Sporme, who founded a college and chantry in the town in the reign of Henry VI. Pope Boniface VIII. was incumbent of this church at the time of his elevation to the pontifical chair in 1294. Sir Richard Empson, Chancellor of the Duchy of Lancaster in the reign of Henry VII., was the son of a sieve maker in this town; his extreme rigour and cruelty in enforcing the penal statutes so exasperated the people, that Henry VIII. found it expedient to yield to the universal cry of indignation, and he was tried at Northampton, and beheaded August 16, 1510. Silk and lace are manufactured here; the latter in considerable quantities, both in the town and in the neighbouring villages. A market is held on Tuesday.

The Roade Station, 60 miles from London, 52¼ from Birmingham. At this place a great difficulty presented itself in the construction of the line of road; it was necessary to pass through a range of hills called the Blisworth Ridge, composed of rock, and extending a considerable distance. The Grand Junction Canal is carried through by means of a tunnel 3080 yards in length, about a mile distant from the railway, and nearly parallel to it. The railway was constructed by blasting the rock and filling up the hollows with masonry.

Blisworth Station is an intermediate one, 62½ miles from London, and 49¾ from Birmingham. Blisworth is situated on the road from Towcester to Northampton; a lofty viaduct carries that road over the railway. Emerging from the Blisworth cutting, a view of the Nen Valley is obtained; and the railway continues by alternate cuttings and embankments through Stowe tunnel, 490 yards in length, to

Weedon Station, 69¾ miles from London, and 42½ from Birmingham. This is the nearest principal station to the important town of

Northampton. The obstinate and ill-advised opposition of the corporation of Northampton and some of the neighbouring gentry, to the original plan of the Railway Company, was a great impediment to the progress of the undertaking, and caused an additional expenditure, estimated at not less than 500,000*l.* They now expiate their folly and illiberality by unavailing lamentations, for the loss they so wilfully and eagerly brought upon themselves, by opposing the passage of the railway by a route which would have passed close to the town. Northampton is connected with many important historical events, and numerous councils and synods have been held there. A destructive conflagration consumed the greater part of the town in 1675, when above 600 dwelling-houses were destroyed, and a greater number of families consequently deprived of their habitations and property, and many were reduced to great distress. A liberal subscription, however, soon enabled the inhabitants not only to rebuild their houses, but to raise from the ruins a far superior and handsomer town than the old one.

ANOTHER MECHANICAL AND CHEMICAL SOCIETY.

To the Editor of the Mechanic and Chemist.

Sir,—I should be happy to join a society for the study of chemistry and mechanics, if situated in the neighbourhood of Bishopsgate or Shoreditch. I am so limited to time, as will not permit my attendance at any great distance. I have, therefore, great pleasure in stating, that there is a large room, situated in Shoreditch, that can be had for such a purpose without any expense; and there are a few juveniles

residing in this locality, that would willingly join such a society. If you will do me the favour to give publicity to this suggestion, and if any of your readers are disposed to avail themselves of this offer, and unite with me in the formation of such a society, a line addressed to me will be duly attended to.

I remain yours, &c,

R. Smith Jeffs, jun.

81, Shoreditch, London.

To the Editor of the Mechanic and Chemist.

Sir,—Having received on Tuesday a letter from "Tyro Chemicus," stating that a meeting would be held at 37, Sussex Street, Tottenham Court Road, on Wednesday the 26th, for the purpose of forming a Mechanical and Chemical Society; I accordingly went to the above-mentioned place, where I saw a gentleman who stated himself to be Mr. Clark, and he expressed his surprise when I told him I had come there for the purpose of attending a meeting, and said he had not received any communication from "Tyro Chemicus" to that effect, or he would have prepared for it. I write to you, Sir, hoping you will allow this a place in your pages, not knowing whether a letter addressed to the Essex and Temple Coffee-house as usual, would meet the eye of "Tyro Chemicus," who will, no doubt, be glad to give an explanation to the above, for the satisfaction of all parties concerned, through the medium of your widely circulated periodical.

I remain yours, &c.,

J. Mitchell.

[We trust that this mistake (which we feel quite confident will be satisfactorily explained) will not deprive the Society of a worthy and valuable member; but we take the liberty of suggesting the expediency of communicating directly with the parties immediately concerned, when their address is known. "Tyro Chemicus" will receive a communication per post.—Ed.]

MISCELLANEA.

The Himalaya Mountains.

(From Major Lloyd's Narrative, &c.)

Many of the mountains around Semla, which are the mere vassals of the mighty Himala, would be the boast of other countries—as Wartoo or Huttoo 19,673 feet, Jungala between 10,000 and 11,000 feet, the larger Shallee 9,623 feet, the Choor Pahar 12,149 feet, and Jukko 8,120 feet. Over these the snowy range extends from N. 30 deg. W. to N. 70 deg. E., embracing consequently an angle of 100 degrees. The general appearance of this mass of snow is that of a wide undulating plain, from which peaks rise in every imaginable shape. Their general height is from 16,203 to 25,749 feet, from 1,000 to 10,000 feet of which is covered with eternal whiteness; the disputed line of perpetual snow on the southern side of this first high chain being 15,000 feet. Between these peaks are the Passes which lead into Koonawr and Chinese Tartary, the principal of which are those nearest to us—as the Shatool 15,555 feet, the Yoosoo 15,877 feet, and the Boorendo 15,171 feet. This first barrier, however, is but the screen to other assemblages of higher mountains, which again are still the inferiors of the world-like bulwarks on the left bank of the Indus, from whence they slope to the Steppes of Tartary, and are at length lost in the immeasurable deserts of Cobi, and the deep woods and countless marshes of Siberia. The summits of this highest range have been estimated, upon good grounds, by my most adventurous and intelligent friends, J. G. Gerard and A. Gerard—who alone have explored many portions of these wild recesses—to rise to the enormous elevation of 30,000 feet. Within these towering bounds, the general appearance of the region is mournful and barren. There, surrounded by the most gigantic pinnacles of the universe, Sublimity sits fettered to Desolation. It awes the mind.

Land Slip.—A singular occurrence is related to have taken place near Salins, in the district of the Jura, on the night of the 29th-30th of January. A mountain, called the Cernans, has come down in mass on the plain by which it was surrounded, and a portion of the royal road from Dijon to Pontalier has sunk with this great landslip, to a depth of more than 50 metres. That portion known as the *Rampe de Cernans* (the ladder or staircase of Cernans) is rendered impassable, and all communication between Cernans and the border of the Doubs is cut off. During the day of the 30th, a fresh mass of earth and rock detached itself, and slid down with a motion sufficiently rapid to be distinctly perceived at a great distance by the naked eye—displacing in its fall an additional portion of the road. It was apprehended that the mischief might spread much farther, and the conjectures were various as to the cause of the disaster. By some, it was attributed to cuttings made at the foot of the mountain for the formation of a new road; others were of opinion that a fountain, which ceased to play upwards of five-and-twenty years ago, must have taken a subterranean direction, and mined out a portion of the mountain. Happily, no lives have been lost.—*Athenæum.*

Cooking in the Seventeenth Century.—In "May's Accomplished Cook," published in 1685 (and quoted in the "Pictorial England"), is the following curious account of the *cuisine* of that period:—*Receipt to make a Herring Pie.*—Take salt herrings, being watered, wash them between your hands, and you shall loose the fish from the skin; take off the skin whole, and lay them in a dish; then have a pound of almond paste ready; mince the herrings, and stamp them with the almond paste, two of the melts or roes, five or six dates, some grated manichet, sugar, sack, rose water, and saffron; make the composi-

tion somewhat stiff, and fill the skins; put butter in the bottom of your pie, lay on the herring, and on them dates, gooseberries, currants, barberries, and butter; close it up, and bake it; being baked, liquor it with butter, verjuice, and sugar. Sometimes, however, the dishes, though equally fanciful, were of a more refined character: thus we read of "an artificial hen made of puff paste," with her wings displayed, sitting upon eggs of the same materials, where in each of them was enclosed a fat nightingale, seasoned with pepper and ambergris The same artificial taste prevailed in the preparation of the simplest materials of food. Butter, cream, and marrow, ambergris, all kinds of spices, sugar, dried fruits, oranges, and lemons, entered largely into the composition of almost every dish. Several articles also appear to have been dressed that would scarcely find admission into a modern English kitchen—such as snails, which were stewed or fried in a variety of ways with oil, spices, wine, vinegar, and eggs, and the legs of frogs, which were dressed into fricasses. On some occasions, therefore, a coarse and clownish dish was a pleasing variety. In the year 1661, a gathering of marquises, lords, knights, and squires, took place at Newcastle, to celebrate a great anniversary, when, on account of the number of guests, each was required to bring his own dish of meat. Of course it was a sort of competition, in which each strove for pre-eminence; but the specimen of Sir George Goring was reckoned a masterpiece. It consisted of four huge brawny pigs, piping hot, bitted and harnessed with ropes of sausage, all tied to a monstrous bag pudding.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 12, the Rev Dr. Vaughan, on Ancient Egypt. At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 10, Hugh Murray, Esq., on European History. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 10, Dr. Cantor, on the Nervous System. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street.—Monday, March 9, the Rev. William Vidler, on the Natural History of Mammalia:—Flesh-eating Animals. At half-past eight precisely.

QUERIES.

Can any of your correspondents inform me where I can purchase a small cheap seraphine, or the notes of one—not the keys? S.

The process of stuffing birds? J. B. L.

How to melt brass with a common fire, and what would be most proper to cast it in?
C. J. A.

How to make varnish for prints and maps? How to make rice glue? E. L. L.

[Every variety of varnish has been described in the "Mechanic." Dissolve gum copal in spirits of wine; or if that is too dear, take gum mastic, or any other you please.—Ed.]

1. How to make a bottle-jack? 2. How to make Venice turpentine? 3. How to make the apparatus for elliptic turning? 4. How to make marble paper? E. Ledger.

How to take the outer skin off bladders, so that, when filled with hydrogen gas, they will ascend like a balloon? J. P.
Birmingham.

Can any of your correspondents furnish me with the ingredients and process employed in what is called "gum-sugar boiling," such as barley-sugar, sugar canes, &c.? I am unable to produce that hard glossy substance employed for their formation. The more I boil loaf-sugar, the less the particles seem to adhere, and ultimately the whole becomes a dry powder. Also, the name of some good cheap work on sugar-boiling, as I am afraid those I have consulted are not to be depended on. A. E.
Birmingham.

The best method of dying silk crimson, blue, and purple; and also discharging colours for dying? E. Wort.

A few weeks back I got the machine into order, and charged the jar; directly after which I got the cat to put one of her feet to the jar, and with the other touched the ball, when I could see she had received a severe shock; the next day the cat was noticed to be rather bad, and every day got worse (it seemed as if she had got the lock-jaw, and could not eat anything, and scarcely drink), and at the end of eight days the cat died; what should you think was the cause of her death?—At what rate does a small balloon about one foot and a half diameter travel, and the longest distance it is supposed to go?—What is the longest time it is before bursting, and what weight it will carry? Mercer.

The receipt for making a much approved ink called magnum bonum? Wm. Conquest.

Being in want of a small seraphine, and having by me an electrical machine with apparatus complete; also two excellent compound microscopes that I wish to dispose of; perhaps among your numerous readers I may find one with whom to effect an exchange. Should this meet the eye of anyone so disposed, a letter addressed to "G. S., care of Mr. Puttock, Newsvender, 26, Grafton Street, Soho," will reach me:
O. C. R.

1. Does the vinous fermentation always precede the acetous fermentation; or, can the latter take place without the former? 2. Is the cream of lime used by coal-gas manufacturers, for the purpose of abstracting carbonic acid from the carburetted hydrogen, or to abstract carbon? 3. By what means must the flow of oxygen through an Argand burner be regulated, so that no gas pass through but what is absolutely necessary in using the Bude light? 4. How many feet of gas per hour should an Argand burner, half an inch wide, consume of oxygen, for the above?
An Amateur Chemist.

1. The best method of refining oils, such as gallipoli, rape, and seal?—2. What proportions of water and acetic acid would make vinegar equal to strength 18°, and how to colour it? 3 How to make the best Prussian blue?

H. W.

The method of making, and the ingredients contained in lozenges? CONFECTIO.

The best means to prevent the back of the hands from chapping? A. S.

ANSWERS TO QUERIES.

To take Stains out of Mahogany.—Stains may be taken out of mahogany by spirits of salt (muriatic acid).

"C. G. Sidney." Lead is the most durable in the open air, but is more expensive than zinc.

To make Iron Cement.—Take of sal ammoniac, two ounces; sublimed sulphur, one ounce; and cast-iron filings, or fine turnings, one pound. Mix them in a mortar, and keep the powder dry. When it is to be used, mix it with twenty times its quantity of clean iron turnings or filings, and grind the whole in a mortar: wet it with water until it becomes of a convenient consistence, when it is to be applied to the joint: after a time it becomes as hard and strong as any other part of the metal. A cement that will resist the action of boiling water and steam, may be made by mixing boiled linseed oil, litharge, and white lead, mixed up to a proper consistence, and applied to each side of a piece of flannel or linen, and then placed between the plates before they are joined.

E. LEDGER.

To make Transparent Soap.—Heat together equal parts of tallow, soap, and alcohol. The heat applied to effect the solution should be as slight as possible, to prevent evaporation of the spirit. The solution being effected, must be suffered to settle; the clear liquid is then to be drawn off into the frames of the form desired for the cakes of soap. It does not acquire its degree of transparency till a few weeks' exposure to dry air. G. W. S. PIESSE.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the "MECHANIC AND CHEMIST" is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half a Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half a Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press*, 1, *Long Lane, Aldersgate Street.*

R. S. L.—*We shall be glad to see his treatise, and, if approved, it will be inserted.*

S. W. B.—*The cause of a liquid rising in an inverted cup when heated and allowed to cool, is the contraction of the internal air at the lower temperature, which renders it no longer capable of resisting the external pressure.*

A Country Mechanic.—*There appears to be a mistake in the name of the inventer of the velocipede referred to; instead of "Ritchie," it should probably have been "Revis" (See page 177, No. XV. N.S.) We should like to see the plan proposed by our correspondent. Advertising the prices and places of sale of books, would subject us to the advertisement duty; it is for this reason that the prices of books are never mentioned in reviews. We have before stated, that this kind of information may be obtained at any bookseller's.*

Manipulator *wishes to obtain a situation in a laboratory, or any chemical establishment. We cannot publish his address, but it may be obtained by application at our office.*

W. Scott.—*The north pole of a maguet attracts the south pole of another magnet; but two north, or two south poles, repel each other. Both the north and south poles attract iron; and in the powerful magnets called "horse-shoe magnets," the two poles are brought together by bending the magnetized bar. If a piece of loadstone be immersed in iron filings, it will be found, when taken out, to be covered all over with particles of iron; at two opposite points they will stand erect, and these are the poles; in the intermediate parts they will incline more and more, till at the point which is at equal distance from the two poles, they will lie down flat on their sides.*

W. W.—*A brief account of the system of shorthand, which he has successfully practised, would, we should think, be acceptable to many of our readers. Our correspondent being a good mathematician, as well as a sound logician, we feel convinced that his explanations and his reasoning will be alike clear and accurate. The diagrams may be accurately executed in wood; but the figures should not be too small and crowded.*

E. L. L.—*The pistons of air-pumps are usually formed of circular collars of leather. We are not aware of any other substance being more convenient, or in any respect better suited to the purpose.*

F. P. H. Truman *will find that we have made an arrangement to obviate the inconvenience he complains of. It is not in our power to do anything to forward his views respecting the machine for cleaning knives, unless he wishes his invention to be made public, or states upon what conditions he is willing to reveal his secret.*

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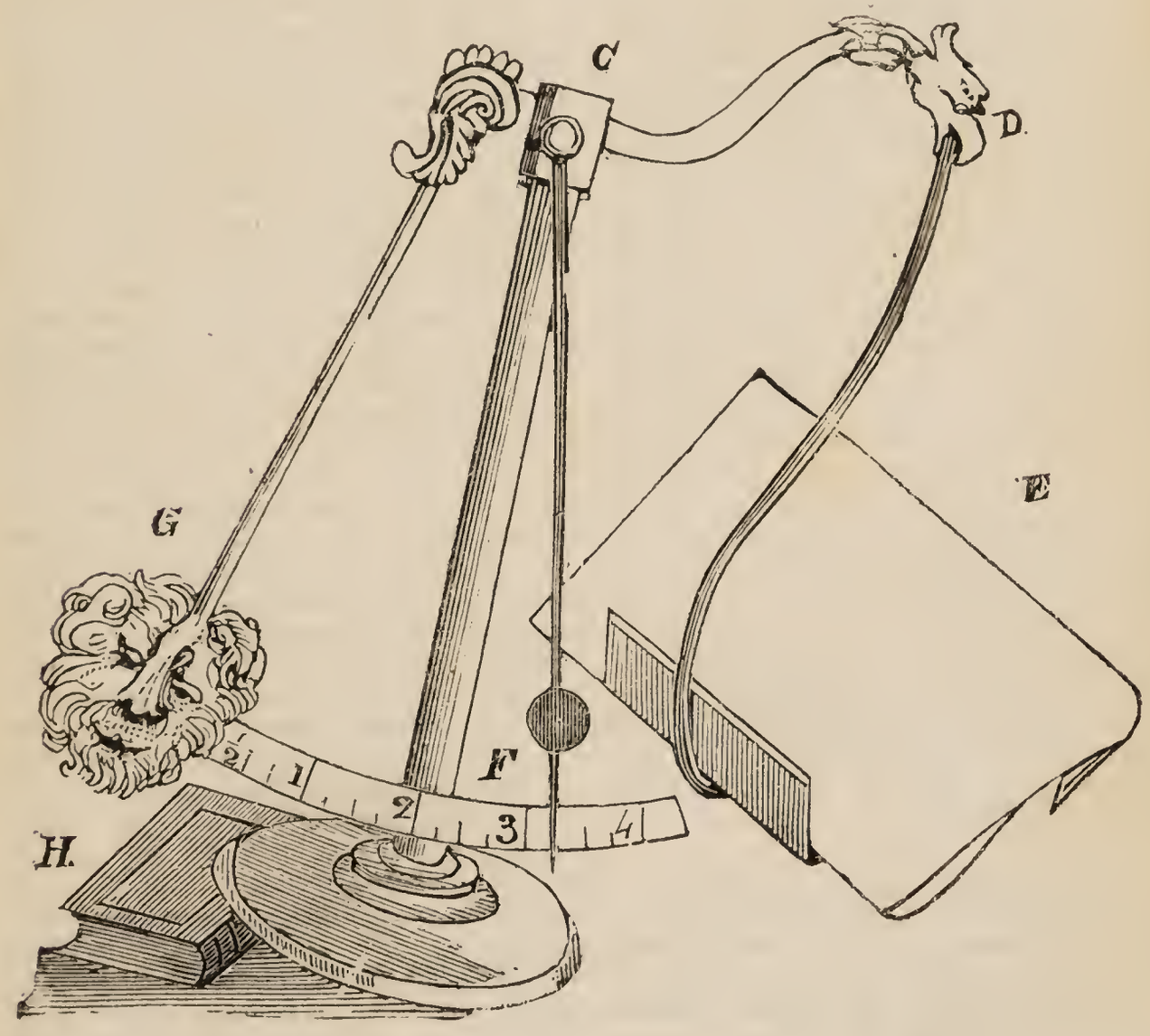
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 81, NEW SERIES. } SATURDAY, MARCH 14, 1840. PRICE ONE PENNY. { No. 202, OLD SERIES.

RADCLIFFE'S IMPROVED SELF-ADJUSTING METROPOST.



Vol. V.—No. 32.] City Press, 1, Long Lane, Aldersgate Street : D. A. Doudney.

RADCLIFFE'S IMPROVED SELF-ADJUSTING METROPOST.

(See Engraving, front page.)

SINCE the establishment of the new post-age system, a multitude of models have appeared, all pretending to some superiority either in accuracy or in rapidity of operation, above an ordinary scale. But however ingenious many of them may be, it does not appear that any of them are considered satisfactory by the Post Office authorities; and it is probable that no self-adjusting scale will be permanently adopted, where expedition is so important an object as it is at the Post Office. In an ordinary scale adjusted for any given weight, it is seen immediately whether the object to be weighed preponderates or not; but in a self-adjusting scale, at least in all those which have hitherto appeared, it is necessary first to wait till the vibration has subsided, and then to examine a scale and index, in which last operation an error is very likely to occur. Mr. Radcliffe's metropost is by no means exempt from these objections: but it possesses an advantage above all others that have been offered to the public, and that advantage seems likely to render it of great utility, and of far more extensive application than the weighing of letters. This machine will indicate the accurate weight, without being placed in a true perpendicular position, as is requisite with other self-adjusting scales. The engraving (see front page) represents the "metropost," thrown out of perpendicular by an obstacle, H, on which one side of the foot rests; E is the letter, suspended from the point, D, of a beam, which moves about the centre, C; G is a weight fixed to the index, and the beam, C; D and F, is a weight *suspended* from the centre, C; so that the angle, G C F, is equal in all positions of the machine, and, consequently, the true weight is always indicated.

LOCOMOTIVE STEAM-ENGINES.

AT the last meeting of the Institution of Civil Engineers, Mr. J. Parkes presented a communication on the subject of steam engines, from which the following is an abridged extract from the report in the *Athenæum*:—

"The locomotive differs from the fixed non-condensing engine only in the use of the blast, and the same method of measuring the effects of the steam are applicable to both. Experimenters on the locomotive have generally attempted to determine the amount of resistance opposed to its progress, in preference to ascertaining the power expended in overcoming the resistance. The exact solution of either of these questions would furnish all that is wanted; but the ascertaining the total resistance by an analysis of its several constituents, is attended with great difficulties, as the forces to which they are to be referred are so exceedingly numerous and variable, that the assigning the exact value to each at any one velocity, has hitherto eluded the talents of those who have pursued this method. M. de Pambour was the first analyst whose labours will require attention. The results given by this author in his practical treatise on Locomotive Engines on Railways were compared by Mr. Parkes, with the results which he had obtained when experimenting on an engine of precisely a similar character, and discrepancies presented themselves which appeared totally irreconcileable. These and other circumstances led the author to consider, whether the resistance to traction would properly be deduced from the laws of gravitation, or whether any certain results would be derived as to the amount of resistance on a level, from observations on engines and trains moving down inclined planes. The great object seemed to be, to discover some criterion of the mechanical effect produced by a locomotive at all velocities, which would apply as practically and as distinctly to a locomotive, as duty to a pumping engine, or horse power to a rotatory engine. If this were possible, it seems of far less importance to distinguish the precise value of each particular unit of resistance, than to determine the relative sum of resistance, and the relative expenditure of power at all velocities and under all circumstances. Now the term duty may be applied, in the strictest sense of the term, to the work done by a locomotive engine; for whether the engine drag a load, whose resistance is 8lb. per ton, or whether a weight of 8lb. for each ton of matter moved, descending over a pulley and attached to the load, be considered as the moving force, the result is the same. If, then, the tractive force or resistance per ton of matter in motion, which is the real load on the engine, be ascertained, the whole effect is found by multiplying this sum by the space passed over in feet; and the consumption of water as steam, and of coke, being known, we have all the elements requisite for determining the duty performed by the steam or coke. The pressure against the pistons may be deduced from the sum of the resistances first calculated on the assumed resistance over-

come at the velocity of the engine in each experiment; and the pressure on the pistons may also be deduced from the ratio of the volumes of the steam and water consumed."

The results of numerous experiments obtained on these principles, are detailed in a tabular form; and, in another table, the same experiments are reduced to terms of horses' power, exhibiting the absolute power resulting from the steam used, that required to overcome the assigned resistance, and the power which balances the effective duty; and the author arrives at the conclusion, that they are inconsistent with locomotives.

"A condensing engine, placed on wheels, with water of condensation transported for its supply, and made to drag a train along a railway, would require the same expenditure of water in steam, to produce a given effect, as if fixed. A non-condensing engine, also, is one and the same machine, whether fixed or locomotive, excepting that the latter must consume more power than the former, to do equal work, at like pressures, by the amount of the additional resistance arising from the contraction of its eduction pipes, in order to produce a fierce blast of steam through the chimney. From these and other causes, the fixed non-condensing engine must be the more economical of the two; but if the results derived from M. de Pambour's data be correct, we must acknowledge the fixed non-condensing engine, with its simple atmospheric resistance, to be far inferior in economy of steam to the locomotive, with its plus atmospheric resistance. The experiments by Dr. Lardner were made for the purpose of determining the resistance opposed to progressive motion on railways. They consisted in dismissing trains at various speeds from the summits of inclined planes, and in observing their velocity when it became uniform; the resistance at such velocity being equal to the accelerating force of gravity down the inclined plane. The results of these are tabulated in the same manner as the preceding, and the most singular discrepancies present themselves. For instance, it would appear, that in one particular case a duty of double the amount of that effected by the condensing engine, was performed by an equal expenditure of power; that, compared with a fixed non-condensing engine at equal pressure, the locomotive, though labouring against the heavy counter-pressure of the blast from which the other is free, is assumed to have performed equal work with less than one-half the expenditure of power. That if the resistance assigned by Dr. Lardner, as opposed to the progressive motion of the train be correct, the efficiency of the steam in the locomotive, is more than double that obtained by the best condensing engines; more than treble that derived from stationary non-condensing engines, and equal to the performance of a Cornish expansive engine, doing a fifty-million duty with a bushel of coals. With such results before us, the resistances assigned as opposed to, and overcome by the locomotive at different velocities, must be regarded as utterly inconsistent with reality, and as resting on no solid foundation. The preceding results show, also, that errors have crept in by the adoption of the theoretical method of reducing undulatory surfaces to a level. M. de Pambour extends the length of the road as a compensation for the acclivities, or for the help afforded by the bank engines, and Dr. Lardner diminishes the time of the journey to that which he assumes would be occupied in performing it on a dead level. If the principles on which these corrections for the acclivities and declivities are made be correct, other facts than we are at present acquainted with must be taken into account, before it can be demonstrated that a given power will convey a given load, at some certain increased velocity, along a level compared with the actual velocity on any given undulating line. The resistances which enter into the composition of the sum of the forces, are ever varying to such an extent, that it may be doubted whether the theoretical level be not a pure fiction, with reference to the practical results of the experiment.

The effective power of a locomotive engine, or the excess of power, after overcoming its proper friction and the resistance from the blast, is solely expended in the generation of momentum. This, which is the product of the mass and the velocity, represents the useful mechanical effort exerted by the steam, and may always be ascertained under all the practical circumstances of railway traffic. The consumption of power as water, in the shape of steam, is a third quantity, which may also be readily ascertained. The application which may be made of the above data, is comprehended in the following propositions:—First, that equal momenta would result at all velocities from an equal amount of power expended in equal times by the same engine, if the forces opposed to progressive motion, and to the effective use of steam in the engines, were uniform at all velocities. Secondly, the difference

between the momenta generated by a unit of power in a given time, at various velocities, measures the difference in the sum of the resistances opposed to the power at those velocities. Having ascertained the gross weight of an engine, tender, and train—their mean velocity—and the expenditure of water as steam during the journey, simple computations will inform us of

1. The mechanical effect realized by a given power at all velocities.

2. The total increase or decrease of resistance at all velocities.

3. The ratios which the increase or decrease of resistance, at different velocities, bear to the ratios of those velocities."

Our limited space will not allow us to follow the author through his elaborate researches, but he is led to the conclusion, that the determination of the performance of locomotive engines by the methods he has set forth, is as practicable, exact, and demonstrative of their relative powers and dynamic excellence, as the determination of duty done by pumping engines. The intensity of the pressure on the opposite side of the piston arising from the blast, has been but imperfectly stated. By some, the discharge of the steam has been likened to a jet, and considered continuous. But an attentive observer can appreciate by his ear, that an interval exists between the alternate discharges of steam from the two cylinders. That these jets are periodic and not continuous, is also distinctly evidenced by the audible pulsations in the chimney, even at the very highest velocities of an engine, and their duration may be measured at lower speeds. Upon this intermittent action of the blast depend, in a great measure, the resultant pressure against the piston, and the production of a sufficient current of air through the fire, both which effects would be materially changed in intensity by the substitution of a continuous for a periodic current. The precise duration of the jet, or of the time of the steam evacuating the cylinder, can only be determined by direct and careful experiments; but its period may be ascertained within definite limits; for since a single discharge is completed within the time occupied by the piston in accomplishing a half stroke, and the pauses between two successive discharges are distinctly perceptible, a single blast cannot occupy the fourth part of the time of the revolution of the crank shaft, and very probably does not exceed the eighth part, or the period of a quarter stroke of the piston. Under no circumstances, then, can the pressure from the blast oppose the piston much longer than during one-fourth of the stroke. With an active pressure, then, of 30 lb. per square inch, the mean resistance from the blast would not be greater than 7½ lb.; and with a pressure of 15 lb., not greater than 3¾ lb. per square inch, against the pistons. The author then proceeds to cite several observations and experiments made by himself, which are confirmatory of the preceding argument respecting the blast; and he was led conclusively to the fact, that one-fifth of the power of the engine experimented upon, at working pressures of 20 lb. and 15 lb., was absorbed in blowing the fire; and that the escape of the steam from the cylinder was four times swifter than the motion of the piston.

The author lastly treats of the expenditure of power for a given effect, by fixed and locomotive non-condensing engines. But few experiments on the expenditure of steam for a given effect, by non-condensing stationary engines, have been made. The relative consumption of fixed condensing and non condensing engines, has been treated of by the late Mr. Charles Sylvester, of Derby, whose knowledge and accurate theoretical analysis of the subject are shown, by the close accordance of his conclusions with the facts established on two engines of these classes at certain working pressures. His conclusion, that the relative economy of these engines will be as the quantities of steam consumed, or as 1 to 1.72 at those pressures, is accurately confirmed by the results here recorded. Mr. Sylvester also showed, that by increasing the pressure upon the same non-condensing, and by enlarging the area of the condensing engine's cylinder and air pump, so as to maintain the steam in it at a uniform pressure per square inch for all loads, the economy of the former would gradually approach, and finally equal that of the latter."

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 226.)

THE CHEAPER METALS THAT HAVE IMPORTANT USES IN THE ARTS.

Manganese, Iron, Zinc, Tin, Lead, Copper, Bismuth, Antimony, Arsenic, Cobalt, Nickel, and Chromium.

MANGANESE.—28.

MANGANESE is a hard, brittle, greyish-white metal, resembling cast-iron, is soon tarnished when exposed to the air, and is not found in an uncombined state. The

compounds which contain it are chiefly the native or black oxide, which is a peroxide.

Peroxide of manganese is a black, hard, and somewhat brittle compound, containing 1 atom of the metal 28, and 2 of oxygen 16, making its equivalent 44.

By heat it gives up part of its oxygen, hence it is used for procuring this gas. When muriatic acid is poured upon this oxide, chlorine is evolved from the decomposition of the acid; hence large quantities of this oxide are used in the preparation of chlorine, for the purposes of bleaching and preparing the chloride of lime. It is used in small quantities in glass-making, to remove the green or yellowish colour; but in larger proportions it communicates a purple colour. The specimens of purple glass, such as the hyacinth glasses, are coloured by this oxide. The black glazing on earthenware, sometimes called black earthenware, is coloured by the same material.

IRON.—82.

Iron is the most useful and most abundant of all the metals; indeed there are few minerals in which its presence cannot be detected. It is the hardest and toughest of all the useful metals; hence its indispensable use in making agricultural and cutting instruments. Should the art of working iron be lost, there is no metal that could supply its place, especially for implements of cutlery. Its hardness may be very much increased by being heated and suddenly cooled. By heating it to redness, it is remarkably soft and pliable, and may be intimately incorporated or welded with another piece of red-hot iron by hammering, a property possessed by no other metals except sodium and platinum. Iron has the specific gravity of 7.7, and when pure it is nearly infusible; but, when combined with carbon, it melts at a bright red heat. It is attracted by the magnet, and may be rendered permanently magnetic; a property of the highest importance to man, which is possessed by no other metals except cobalt and nickel.

The ores of iron that are wrought for obtaining the metal, are the oxides, which are exposed to a high heat in a furnace, mixed with charcoal and lime. The charcoal takes away the oxygen, and a small portion of it unites with the metal, rendering it fusible. The lime at the same time uniting with the impurities of the ore, forming a fusible compound called *slag*, which floats on the surface of the melted metal, and prevents it from being oxidized by exposure to the atmosphere. The particles of metal at the same time, as fast as reduced, run down into the lower part of the furnace, where it is drawn off through a small aperture, previously closed with a plug of clay.

The iron thus obtained, is the common cast-iron, of which iron pots, kettles, stoves, &c., are made. It consists of about 5 per cent. of carbon, and contains many impurities, such as earthy substances; by heating repeatedly and hammering it, the carbon and impurities are separated, the metal is drawn out into bars, and is called wrought iron.

Steel is formed by placing in a kind of oven, alternate layers of bars of iron and charcoal in fine powder, and keeping the whole at a red heat for about a fortnight; the charcoal unites directly with the iron, of which it forms about one-and-a-half per cent. At a bright red heat it melts, is poured into moulds, and is then called cast-steel. It is used for the finest instruments.

Iron has a strong affinity for oxygen. In dry air it suffers no change, but when moisture is present, it is rapidly oxidized or rusted; but when heated to redness in the open air, it is converted into black scales, called the black oxide of iron; and in pure oxygen it burns with vivid scintillations.

Oxides of Iron.—Iron combines with oxygen in two proportions, forming the protoxide, which is dark, or nearly black; and the peroxide, which is red, and more commonly called iron rust. The latter is considerably used in the arts. It is used by the silversmiths for polishing their metals, under the name of rouge.

There is a golden-yellow mineral that is taken by the uninformed for gold; it is a sulphuret of iron, often called pyrites; it is very hard, and may be made to strike fire with steel. This mineral is used in preparing copperas, which is the sulphate of iron.

ZINC.—33.

Zinc, or spelter, as it is sometimes called by the workmen, is obtained from an ore called calamine, which is a native carbonate, or from the native sulphuret called zinc blende. The metal is procured by heating the ores with charcoal.

Zinc is a bluish-white metal, of a strong metallic lustre. It is a hard and brittle metal, and has the specific gravity of about 7. Though at common, and at high temperatures, it is brittle, between 212° and 300°, it is both malleable and ductile, and is rolled out into thin sheets, which are considerably used for covering the roofs and floors of buildings.

Zinc is used for making the zinc plates of galvanic batteries. But by far the

largest quantities are used for melting with copper to form brass.

Zinc undergoes little change by exposure to the air and moisture; but when heated to redness in the open air, it takes fire and burns with a bright white flame, forming an exceedingly light oxide, which readily floats about in the atmosphere. This oxide was formerly called, from its lightness, white nothing, philosopher's wool, &c. It is now called oxide, or flowers of zinc.

SOLUTION OF PROBLEM.

To the Editor of the Mechanic and Chemist.

Sir,—May I beg you to insert an omission which appears in the solution of the problem which I sent you last week:—

$$\text{Given } (x+1)\,.\,(x^2+1)\,.\,(x^3+1)=30\,x^3.$$

$$\text{Multiplying, we have } x^6+x^5+x^4-28\,x^3+x^2+x+1=0;$$

And this is divisible into factors $x^2-3x+1=0$, and $x^4+4x^3+12x^2+4x+1=0$.

The first solved gives $x=(3\pm\sqrt{5})\div 2$. The latter is also solvable by quadratics, for it is equal to $(x+1)^4=-6x^2$; or, $(x+1)^2=\pm x\sqrt{(-6)}$.

$$\text{Hence } x=\frac{\pm\sqrt{(-6-2)}\pm\sqrt{(-6\pm 4\sqrt{-6})}}{2}$$

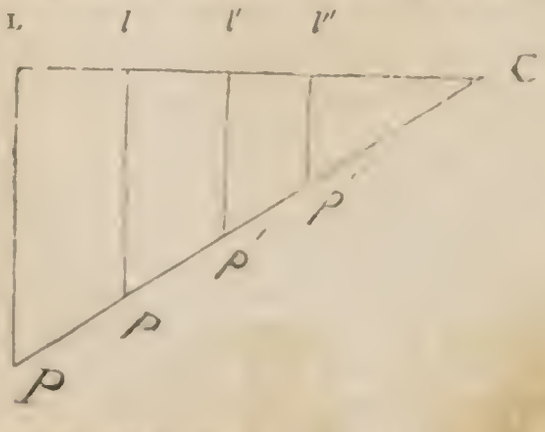
I remain yours respectfully,

J. Yates,
8th Batt. Roy. Artil

ANSWER TO QUESTION IN No. 68.

Question.—A, a pedestrian, is benighted on a large plain, and observes a light bearing directly north from him, and which light is distant from him exactly one mile. The light is carried by B, travelling directly east, at the rate of three miles an hour; but A, erroneously supposing it to be stationary, keeps continually travelling towards it at the rate of four miles an hour. How long will he travel before he comes up with B, and what will be the distances travelled by each of them, from the time the light appeared? Also, required the nature and construction of the curve described by A's route?

Ans.—Let P = pedestrian, L = light, and C = the point of meeting. Then, since the motion of each of them is uniform, the distance travelled by either of them in any time will directly be as the



distance travelled in all; that is, P p : L l :: P C : L C :: P C : l C :: 4 : 3; therefore, the line joining them always points directly north (for $p\,l$ is parallel to L P by the 2.6 Euclid). Again, the distance from each other decreases directly as the distance from the place of meeting decreases; that is, C L : L P :: C l : l p :: C l' : l' p' :: C l'' : l'' p'': and that being the case everywhere, the line P C must be a straight line, since L C is one.

Their length may thus be found:—

$$\text{Let L C} = x;$$

$$\text{Then we have } 3 : 4 :: x : \frac{4x}{3} = \text{P C}.$$

$$\text{But } \frac{16x^2}{9} = x^2+1, \text{ or by reduction and transposition, } 7x^2=9;$$

$$\text{Or, } x^2=\frac{9}{7}\;\therefore x=\frac{3}{\sqrt{7}}=\text{L C};$$

$$\text{And } \frac{\frac{12}{\sqrt{7}}}{3}=\frac{4}{\sqrt{7}}=\text{P C}.$$

L. L.

Improvement in Glass-bottle Blowing.—Messrs. Coutures, Brothers, of Bordeaux, glasss blowers, have just introduced an important improvement into the art of blowing black or bottle glass, by using a flexible tube, worked by machinery, for injecting air into the parcels of fluid metal, instead of letting their men continue to blow them by mouth. An ingeniously-contrived cock allows them to consume just as much, or as little air as is wanted. These gentlemen have declined taking out a patent for their invention, and, in a spirited manner, have made it public.—*Hereford Journal.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, March 18, G. H. Bachhoffner, Esq., on Chemistry. Friday, March 20, G. Bennett, Esq., on Oratory and the Drama. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 19, R. A. Ogilvie, Esq., on Insects, At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 17, M. C. Gascoigne, Esq., on Switzerland. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 17, Dr. Cantor, on the Senses At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street.—Monday, March 16, the Rev. William Vidler, on the Natural History of Mammalia:—Flesh-eating Animals. At half-past eight precisely.

QUERIES.

S. C. H. wishes to know, in making wax flowers, what preparation can be put on previously to painting, to give the paint a soft appearance, and to prevent it from running off, which the greasiness of the wax causes it to do? I also wish to know of what ingredients those flowers are composed, which have a more transparent appearance than wax; and if they are put together with gum or any other ingredient, as I find the weather has not the same effect on them as on wax; and where the composition of which the flowers are made, may be bought, ready prepared?

The method of making and using black japan for furniture? The method I adopt at present is, by grinding a little colour in turps, and mixing with a little copal and white hard varnish; but I do not get that clear smooth surface the London japanners do. Also the name or title of a little work which is a guide to cabinet-makers in such matters? I think such a one was published some few years ago in London, but I do not know its title. R. H. S.

The best and cheapest method of making ginger beer that will keep in hot weather, with or without the use of yeast; without would be preferable, if it could be made fit for use in about two days, to be bottled in common ginger-beer bottles? O. W.

1. How to work out in figures the measurements of deals of different thicknesses; viz., 12 feet long, 11 inches wide, 3 inches thick; 11 ft. long, 9 in. wide, 2½ in. thick, &c., so as to bring them to 2 inches, being generally sold in Liverpool at so much per foot of 2 inches; and also how to work out standard hundred of deals by figures. 2. A good and cheap work out, with instructions on writing commercial letters? 3. Also a cheap book on the harmony of colours? J. Banks.

ANSWERS TO QUERIES.

Receipt for Black Ink.—Into a glazed stone jar or pitcher put one pound of Aleppo galls bruised, then add one gallon of rain water nearly of a boiling heat; let these stand together for fourteen days upon the kitchen hearth; then add green copperas, or sulphate of iron, four ounces; four ounces of logwood chips, one ounce of alum, one ounce of sugar-candy, and four ounces of gum-arabic; let the whole remain ten or twelve days longer in a moderate heat, the mouth of the vessel slightly covered with paper; stir the ingredients with a stick twice a day during the whole time, then strain and bottle; pour a little brandy on the top of the ink in each bottle, then cork them well, and keep them in a place of temperate heat. This ink may be depended upon as excellent, durable, and preserving the writing all a deep black. The best galls are those which are of a dark colour, heavy, and free from grub holes.

To make Printing Ink.—The following is Mr. Savage's receipt for making one pound of printing ink:—Take balsam of capivi, 9 oz.; lamp black, 3 oz.; indigo and Prussian blue, equal parts, 1¼ oz.; Indian red, ¾ oz.; turpentine and soap, 3 oz. This mixture is to be ground upon a slab with a muller, to an impalpable smoothness; a small quantity of acetate of lead accelerates its drying.

To obtain Skeletons of Small Animals.—The most easy way is by burying them for a few weeks, when the bones will be found beautifully cleaned by the worms. They have then to be fixed together by wire. A natural skelcton may be easily made by removing all the soft parts, macerating in water for a short time, and cleaning with a knife, so as to leave the bones attached by their own ligaments. J. J. F.

Zinc requires to be exposed to the action of air and moisture for a considerable time before the coating of suboxide becomes formed; while lead is very soon covered with carbonate by exposure.

Odell's System of Shorthand is very easy, and calculated for rapid writing. I do not know whether there is any system superior to it.

Method of Drawing an Epicycloid.—On the rim of a circular piece of wood, dovetail a blacklead pencil. Lay a rule, or straight piece of wood, upon a sheet of paper; place the circle against it, and roll it along; the point of the pencil will gradually ascend, and trace out a curve called the cycloid. If a hole be bored at any point within the circle, and a pencil slipped through, the curve produced will be the trochoid. If, instead of being rolled along a straight line, it be made to move round the outside of an iron ring, the curve generated by the pencil on the rim will be the epicycloid; by the pencil at the point within the circle, the epitrochoid. If the circle be rolled round the inside of the iron ring, the curve traced by the pencil on the rim, will be the hypocloid; that by the pencil within the circle, the hypotrochoid. If a piece of wire be twisted round the ring, and passed through the centre of the circular piece of wood, and the circle be made to revolve at the same time that the cen-

tre is sliding round the ring, then the curve, generated by the pencil at either point, will be the epicycle. If a loop be tied at the end of a reel of cotton, and the reel be held down upon the paper, then passing a pencil through the loop, and unwinding the thread, the point will describe the involute of the circle. It will be easily seen, that several of these curves are traced by the different parts of wheels, and the sun and planet arrangement of Watt. The involute of the circle is useful for toothed wheels, since the edges are longer in contact, by which means jarring or shaking is avoided. If a piece of string be doubled, and tied in a knot, so that it may be pulled into the shape of the letter O; it is evident that, upon slipping it over a nail, and drawing a pencil round in the other end of the loop, it will describe a circle. If the same string be passed over two nails at a distance from each other, and the pencil be drawn round as before, the curve produced will be an ellipse, or oval.

"T. P." may, perhaps, find this suit his purpose. The erroneous statement which I have made at page 198, I copied from Sir Richard Phillips's "Arts of Life," page 897, line 57. His words are, "Phosphuret of calcium, or phosphate of lime, is obtained in the following manner, &c." Pursuing chemistry only for amusement, and not having sufficiently attended to the *ums* and the *ates* and the *urets*, I supposed, as his words would lead anyone to suppose, that they were convertible terms. "G. Piesse" has my thanks for rectifying it, as it might mislead others as well as myself.

In "S. Rutter's" hygrometer, the scale is upside down. Cords swell, and, therefore, contract in wet weather; consequently, a moist atmosphere would lift the plummet, and a dry one depress it.

The best System of Shorthand.—I have been in the constant habit of writing one myself for many years, and have examined 20 or 30 systems. It is extremely difficult to say which is the best. The one I happened to learn is Blanchard's. The usual way of comparing them, is to count the number of marks required by each, to write out any portion of a speech, psalm, sermon, &c. I never remember to have seen Blanchard's praised. Gurney's has been much extolled. I have it lying before me at the present moment. Blanchard uses fewer marks; indeed fewer than any system I have ever examined, save one, which was written on intersecting lines. That I attempted to use for a year or two, but found it more trouble than it was worth. I have been enabled to copy sermons verbatim, that is, the manner in which shorthand writers understand the phrase, omitting the monosyllables, which may be afterwards easily supplied; but this is more the result of long practice, than the peculiar brevity of the system. Almost any system, unless, indeed, very bad, will enable a person, with continual practice, to write a great deal. In general, the best systems are those in which the letters of the alphabet consist of only one mark. As for any system enabling a person to follow a speaker in a few weeks, as the title pages of some of them announce—*credat Judæus Apella*. He may follow him by walking behind him, but not otherwise.

"Tyro Chemicus" will find a method described in the "Holiday Companion," by which he may cut himself glass cylinders from common vials.

"R. T." may also find a receipt for cheap black ink in the same little work.

W. W.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the "MECHANIC AND CHEMIST" is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half-a-Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half-a Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press*, 1, *Long Lane, Aldersgate Street.*

The Mechanical and Chemical Society.—*We have received several letters complaining, that at the place appointed for the first meeting, no room was provided, and the person who convoked the meeting was not present. The following is offered in explanation by "Tyro Chemicus:"—*

"Having apprised all the gentlemen who had written to me, that a meeting would take place on Wednesday, the 26th of February, I then wrote a letter to Mr. F. Clark; but, instead of posting it, I gave it, unfortunately, to a friend to deliver, on the Wednesday morning; but he forgot it, and, consequently, this unpleasant mistake occurred, which Mr. J. Mitchell complains of, and for which I am very sorry.

TYRO CHEMICUS.

Any letter directed to me at Essex Street, Strand, will meet with immediate attention."

We are exceedingly sorry to find, that a very acrimonious quarrel between two of the members, should partially disturb the harmony which such laudable and pacific pursuits as those which are the objects of this Society might have been expected to secure. We trust that neither of the contending parties will blame us for denying publicity to their communications, and expressing a hope, that much as they may feel irritated at the present moment, a little cool explanation and friendly interposition may effect a reconciliation.

Our next will be a double number, and we shall be able to notice a great many correspondents who are unavoidably omitted this week.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

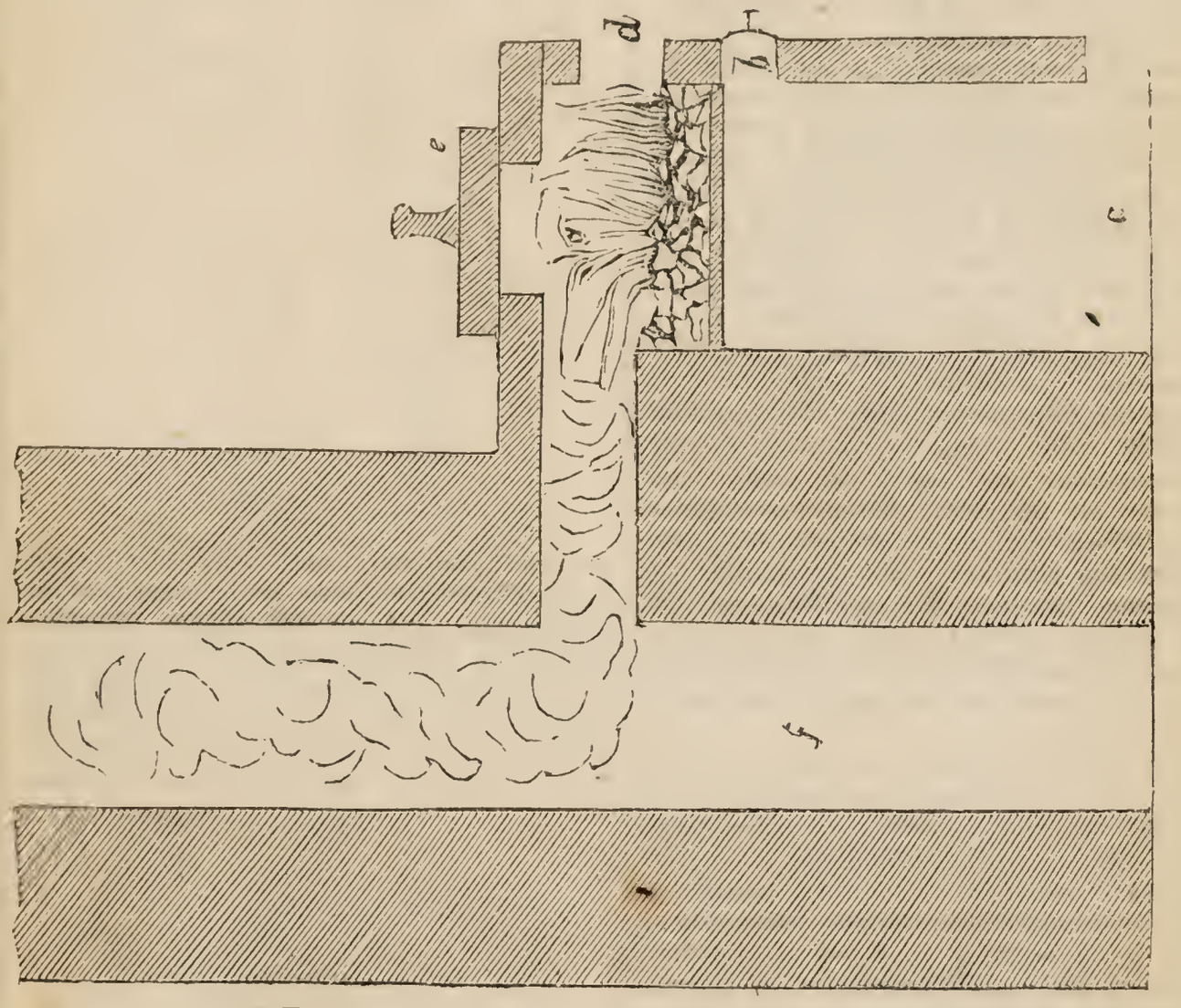
THE

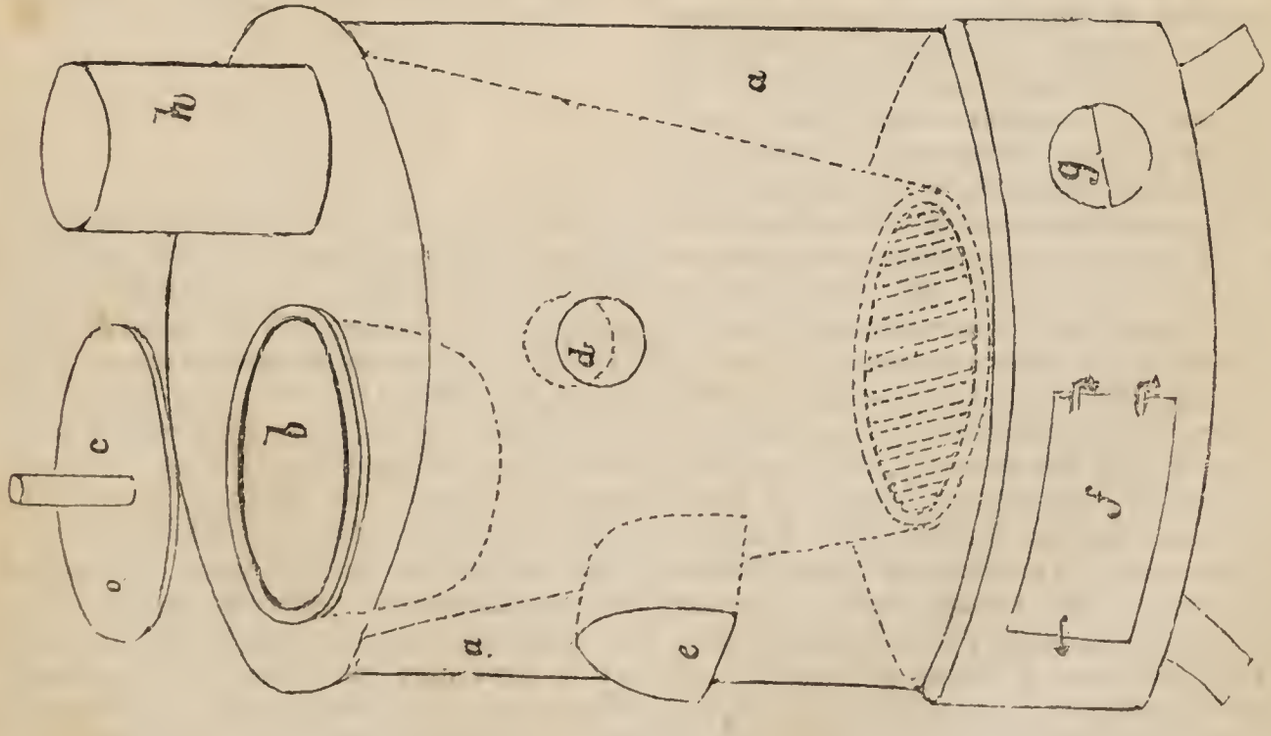
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 82 & 83, NEW SERIES. | SATURDAY, MARCH 21, 1840. (PRICE TWOPENCE.) | Nos. 203 & 204, OLD SERIES.

COMBUSTION.





Vol. V.—Nos. 33 & 34.] City Press, 1, Long Lane, Aldersgate Street : D. A. Doudney.

ON COMBUSTION.

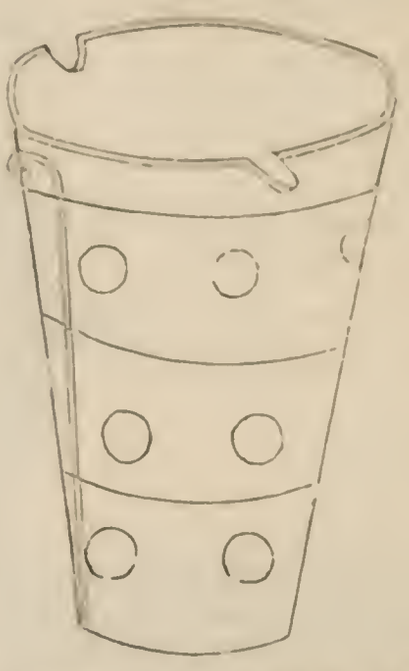
(Continued from page 233.)

In a common fire-place, heat is communicated principally by radiation, the smoke and consumed air ascending in the chimney. The less the quantity of metal, the greater the heat projected into the room. With large metallic bars and plates, a great quantity of heat is continually withdrawn by conduction, as the air which passes by them ascends in the chimney. Sometimes polished brass plates are used with advantage at the sides of particular fire-places, to reflect into the apartment any radiant heat which may fall upon them. Grates are almost invariably placed too high; and branders supporting the fire should be on a level with the floor, and the ash-pan sunk below them.

The term draught is usually employed in reference to chimneys; and when air passes through them quickly, they are said to draw well. The movement of the air depends, however, upon the colder and heavier air meeting with less resistance than before from the expanded and lighter air in the chimney; and the greater the difference between the specific gravity of the external air and that in the chimney, the more rapidly does the movement go on, or, in common language, the better does the fire draw.

For a single furnace, perhaps, none will be found more generally useful than that represented in fig. 1, where *a* is the body of the fire, *b*, the draught-hole, and *c*, the ash-pit; both of which should be furnished with doors, so as to regulate the supply of air; *d*, an opening in front of the fire, useful in making different sorts of gases; it has also an opening at *e*, to introduce crucibles through; these also, should have covers, as represented in the engraving; *f*, the chimney. Another very useful and portable furnace, invented by Dr. Black, is represented in fig. 2, and consists of a case of stout sheet iron, lined to the thickness of two or three inches, with a very infusible clay, or earthy composition. *a a*, an iron pot, for a sand bath, is seen at *b*, with lid, *c*; *d*, is an opening to introduce tubes through; *e*, is the door; *f*, the ash-pan, and *g*, the valve to regulate the supply of air; the chimney, at *h*, may be connected by pieces of tubing. A very cheap and useful furnace for chemical purposes, may be made out of a crucible:—Take one twelve inches high and seven inches in diameter at the top, which may be obtained from a refiner of metals. It is sufficiently soft to be cut with a knife. In this four holes, each rather more than an inch in diameter, and situated at equal distances from each other, are to be made with a gimlet, and enlarged with a round rasp; and above them, two other rings of holes rather smaller, and arranged as represented in fig. 3. It is then to be bound

Fig. 3.



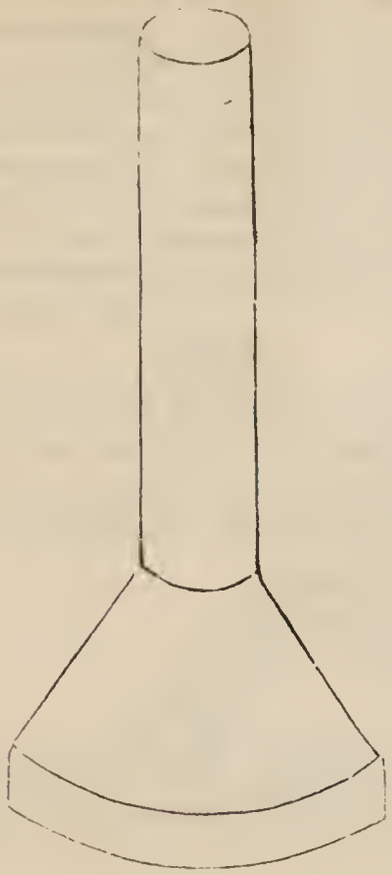
with soft iron wire, one-eighth of an inch in thickness; a piece to be first carried underneath and up the sides. Notches should be made to receive the wires, to prevent them slipping, and to keep the furnace in a firm position. Two small circular grates are next to be provided, of such a size, that one will drop between

Fig. 4.

the two lower rows of holes, and the other between the two upper, by which the fire may be made deeper or shallower, as occasion may demand. Two notches may be cut at the top to receive a tube. The object in binding it with wire, is to hold it together when it cracks, which it is sure to do when heated; this, however, does not impair its efficacy, as may be inferred from the fact, that the writer has had one in use for five years. The fuel for this furnace is charcoal, and if a flue be applied, as represented in fig. 5, a white heat may be raised and sustained. With 20 or 24 bricks, and a few small slips of narrow hoop iron, a small furnace

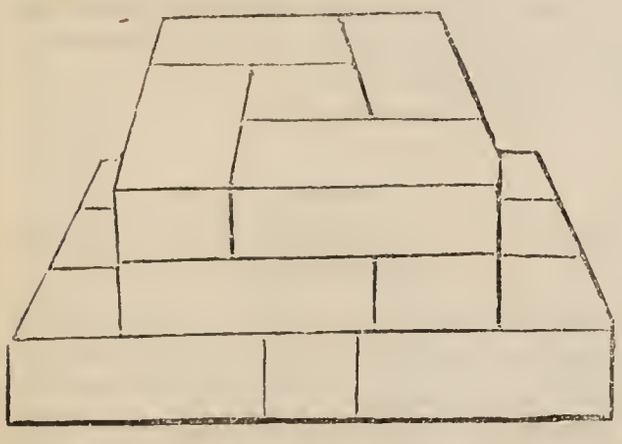
may be constructed in a few minutes, capable of giving a good red heat, where the

Fig. 5.



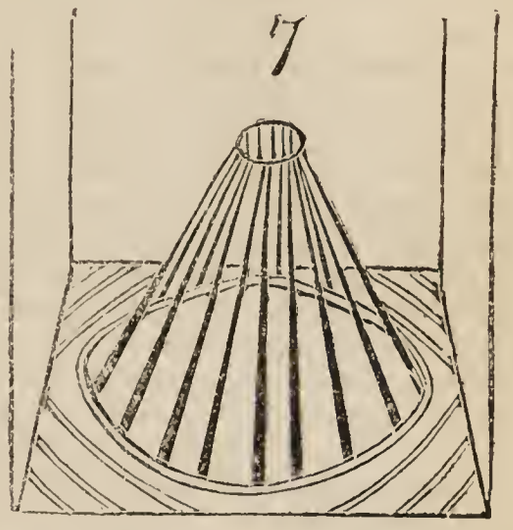
usual facilities for operating are not to be obtained, and where a common fire is not accessible. The bricks are to be placed as in fig. 6; slips of iron being placed in the

Fig. 6.



middle to support the fuel. If the bricks be laid with mortar or clay, the current of air will be still stronger, and the heat greater. An idea once struck me of forming a stove, the grate of which should come to a point, being in the shape of a cone; and I found that the heat, for the size of it, was very considerable, so that a piece of cast-iron, placed at the apex of the cone, was in a few minutes melted. The width of the inside was ten inches, and the widest part of the cone eight. It was lined with fire clay three inches in thickness, and yet I have sometimes seen the whole of it at a red heat. I found a great annoyance from the bars of the cone being so rapidly oxidized, though they were made of wrought iron. A sketch of the cone is seen in fig. 7. I also passed a gun-

Fig. 7.



barrel, lined at the outside with clay, through the body of the stove, and connected one end (by a piece of tubing) with the bottom of the stove, so that all the air which went to supply the combustion of the fire, had first to pass through the ret-hot tube: the heat was increased, but not to any great extent. I also tried the result of passing various gases through the tube, with very curious effects. I passed a current of steam through the fire, which greatly increased the heat. This fact is well known; and a very pleasing experiment is, to put a kettle on the fire, with a tube from the spout to the body of the fire; the kettle should only be about a quarter full, so that when the kettle begins to boil, the steam is forced into the fire, which makes it boil faster, and a greater quantity of steam is produced. Before concluding, I must add, that in all cases where a strong heat is required, all apertures leading into the chimney above the place where the fuel rests, ought to be closed, and any of the apertures leading into the chimney from any furnace not in use, must also be shut; otherwise cold air rushing in by them reduces the temperature of the warm ascending current, and, consequently, reduces the temperature in those furnaces in use, by preventing so rapid a consumption of the fuel.

All furnaces where a steady and regulated temperature is required, must be provided with ash pit doors, by which a fixed and steady supply of air can be admitted and regulated, so as to produce a powerful or more moderate heat. But cutting off altogether the supply of air, the fuel may be kept unconsumed for a length of time. I must now conclude with

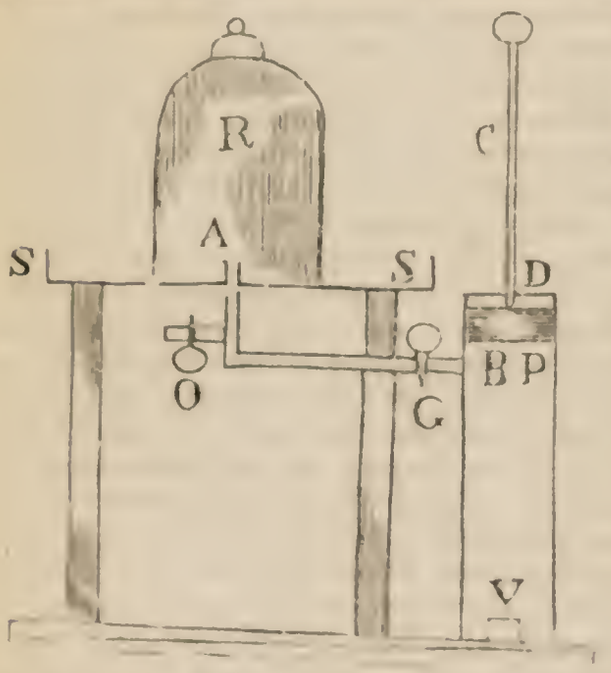
the words of the immortal Davy, "Without combustion, man might have wandered for ever, barbarous and uncivilized, in his native deserts. By the help of combustion, the artist and manufacturer fabricate the tools by which we erect cities, subdue and cultivate the earth, and directly derive our support. Assisted by combustion, commerce erects the stately vessel, subjugates the ocean, showers plenty over every nation, and connects mankind together. By the arts, dependant on combustion, science and philosophy, no longer confined to thinking individuals, exist in characters. The press has made them immortal, and will ever continue to extend their beneficial influence; and, lastly, aided by combustion, the sage devotes to philosophy the solitary hours of midnight, pursuing those combinations of ideas which, producing inventions, improve and ameliorate the condition of man."

FELIX WEISS.

Liverpool.

LEDGER'S AIR PUMP.

R is the receiver, having its lower edge ground smooth, so as to rest in close contact with a brass plate, of which S S is a section; in the middle is an opening, A, which communicates by a tube, A B, with a hollow cylinder, in which a solid piston,



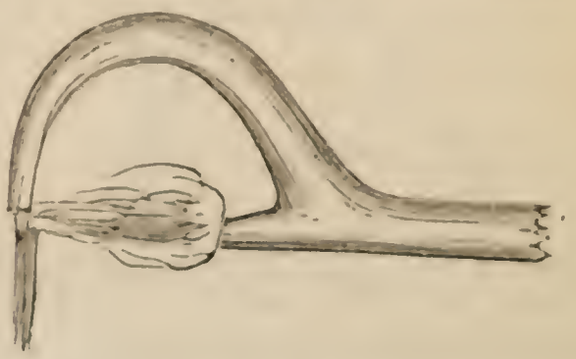
P, is moved; the piston rod, C, moves in an air-tight collar, D, and at the bottom a valve, V, is placed, opening outwards. When the piston, C P, is pressed down, and has passed the opening at B, the air in the barrel, B V, is enclosed, and will be compressed by the piston; it will, therefore, press downwards upon the valve, V, and the air in the barrel will be driven into the atmosphere. The moment the piston begins to ascend, the pressure of the air from without closes the valve, V, completely; and, as the piston ascends, a vacuum is left beneath; but when it rises above the opening, B, the air in the receiver rushes into the barrel, and a second depression of the piston will expel the air out of the barrel, and the process may be continued at pleasure. The communication between the barrel and receiver may be closed by a stop-cock; G O is a stop-cock, to let the air into the receiver.

E. LEDGER.

DOUBLE-JETTED BLOWPIPE.

To the Editor of the Mechanic and Chemist.

SIR,—Permit me to offer the annexed plan for a blowpipe, with a secondary or trans-



verse jet. I have not as yet made the experiment, but leave it for those who, having the leisure and inclination, may be induced, from a presumption of its probable effect of increasing the heat of the first projected flame by a counter-current of air, to give it a trial.

I remain yours, &c.,

J. B.

NOVEL EXPERIMENT IN AEROSTATION.

A SERIES of experiments was privately exhibited in the lecture-room of the Polytechnic Institution, in Regent Street, on Tuesday afternoon, by Mr. Green. That celebrated aeronaut has long entertained the opinion, that a balloon voyage from the continent of America to Europe may be safely and certainly effected, founded upon repeated observations on the atmosphere, which have led him to the conviction, that whatever may be the direction of the winds below, the current of air above invariably traverses from some point between the north and west. Mr. Green has kept a regular log of all his numerous voyages. To get into and remain in this current, it is, however, necessary that the balloon should be kept at a certain altitude; and, to show how this

could be effected, was one of the objects of the experiments. The machinery made use of by Mr. Green is both simple and portable, and it is constructed upon a well known pneumatic principle. It is composed of two fans, or blades of wood, attached to a spindle, which passes through the bottom of the car. The fans are of one longitudinal piece, to the centre of which the spindle is fixed, after the manner of a windmill, with but two wings or arms, and their blades present a given angle horizontally, in which direction they move. The effect was as follows:—A miniature balloon, of about three feet in diameter, was filled with common coal gas. To this were attached the hoop, netting, and car, and in the car a small piece of spring mechanism was placed to give motion to the fans. The balloon was then balanced; that is, a sufficient weight was placed in the car to keep it suspended in the air, without the capacity to rise or inclination to sink. Mr. Green then touched a stop in the mechanism, which immediately communicated a rapid rotatory motion to the fans, whereupon the machine rose steadily to the ceiling, from which it continued to rebound until the clockwork had run out. Deprived of this assistance, it immediately fell. The reverse of this experiment was then performed. The balloon was first raised into the air and then balanced. A similar motion was imparted to the fans, the action of which in this case was, however, reversed, and the balloon was immediately pulled down to the ground by their force. A more interesting effect still was then exhibited. The balloon, with the guide-rope attached to it, was balanced as before, the guide-rope having a small brass weight fixed to the end of it. The fans were then removed from under the car and placed sideways upon it, by which their action became vertical. Upon motion being communicated, the balloon floated in a horizontal line, dragging the guide-rope after it, with the weight trailing along the floor, and continued to do so until the mechanism ceased, when it immediately became stationary again. These experiments were frequently repeated with complete success. Mr. Green states, that by these simple means a voyage across the Atlantic may be performed as easily as one from Vauxhall Gardens to Nassau, and he calculated, that from three to four days will be sufficient for the undertaking. *Nous verrons.* The required size of the fans for his monster balloon would be about six feet in length, and the machinery by which they would be turned would be placed inside the car, to be governed at the will of the persons there. These experiments will probably be practically carried out during the summer, by what appears to us to be, under any circumstances, a most perilous undertaking.—*The Times.*

LIFE ASSURANCE.

NO. II.

EXPECTATION OF LIFE.

ASSUMING the word *probability* to mean, in common phraseology, an event almost certain of happening on the one hand, and, on the other, possible of happening, but not so certain; let us remark, for a few moments, the steps which lead to the act of "assuring a life," by assistance of the "Tables of Mortality."

We have observed, that the expected time, or duration of life, is always calculated by way of average. Hence the necessity of finding some fixed method for performing this operation. It will be acknowledged, the thing most desirable to be known, is the terms upon which this business can be transacted. A plan is first determined upon, of the mode in which the benefit or sum to be assured shall be paid, generally at the death of the individual making the assurance with a society; but this will be noticed more at large hereafter. The present age is next ascertained, and satisfactory proof of it given and by the assistance of a previously prepared table, the premium, or annual payment, from the person to the society during his life-time, is readily stipulated. The preparation of this table is the principal difficulty, and can only be done by an experienced calculator; which leads us to value the information more highly conveyed to us in the bills of mortality, when applied to this object.

We may safely infer, therefore, that from a large number of healthy persons taken together, any one may be selected, whose life we can state the expectancy of. Suppose it were ascertained, that out of such a number of persons chosen, 100 could be found aged 25; then, as we have before shown, they would each have the same expected duration of life, by way of average, which would be, according to the Northampton table, very nearly thirty-one years. With each of these, therefore, there would be the same probability of his or her not living more than one year; and the like probability that either might be the person who would live until the age of 96! Yet experience would testify, that they could not all live until 96, nor die at

the age of 26; however good or bad their lives or health might be; but that a gradual diminution would take place until all were dead. Let us, then, farther ask, upon the probability of these deaths happening, as has been stated, what would be required to assure the sum of 500*l.* at death to each of the party? This, it is true, depends, in some measure, upon the interest that the society anticipates making, or, rather, the interest which they allow the assurer throughout the whole period of his life. Now, were sufficient taken from each, to make good the 500*l.* to be paid at death, it would amount to 16*l.* 2*s.* 7*d.* annually, according to the average period they were expected to live. But this is without making any discount or allowance for the interest the society would be enabled to make of the various premiums; therefore, rather more than 12*l.* would be a proper sum for each to pay, as a yearly premium, to assure 500*l.* to each, as their lives might drop.

There would be advantages arising to any well conducted society, who charged this sum for the mere assurance of 500*l.* at death; therefore, it would be but just for the assurer to have a share in the profits thus accumulated, which offices charging this high premium invariably allow; but there remains much to say on this subject at some future time. Having now explained the way in which the term *expectation of life* is applied to the tables of life assurance, we will pass to enumerate the usual rates of premium the offices charge, in our next chapter; and will take also a glance of the various modes adopted by different societies now existing, with a reference to higher authorities upon this interesting subject.

SIGMA.

WRITING INKS AND WRITING FLUIDS.

To the Editor of the Mechanic and Chemist.

SIR,—As the above subject has now for some time taken the attention of the public and the curious, and is giving rise to discussions, which are gradually eliciting facts of the greatest importance to the security of the public, as well as private records; I beg leave to draw your attention to a few particulars in connexion with writing inks, and which, I believe, are as yet but partially known. In the first place, permit me to say, that the object aimed at by the manufacturers of writing inks, has been to obtain a fine black, and one that would resist the action of time and the atmosphere (the most powerful agent). How far they have succeeded I will endeavour to show, by reference first to some experiments made on the subject by Dr. Birkbeck, at the Mechanics' Institution, a short time since. Dr. Birkbeck endeavoured to show, by experiments on many of the blue inks now in such general use, that they (and one in particular) stood the action of the acids so well, as to appearance to give every assurance of their durability; while, by reference to an ingenious article published in the *News* immediately afterwards, it will be seen, on the testimony of some of the most respectable merchants and bankers, that many of their ledgers, written but a very short time with that very fluid, are now almost illegible; and, it is added, "This fact, together with other tests, show, that with respect to durability, blue inks have no advantage whatever (rather less than otherwise) over other inks, and are not entitled to the character bestowed on them by Dr. Birkbeck." The real fact is, the subject being at the time but little understood, Dr. Birkbeck imagined that acids were the most powerful agents he could employ in his endeavours to extract the colour; not so, the blue ink he experimented upon, was composed in body of prussiate of potash suspended mechanically, and that article will resist the action of acid for any length of time, as will most blue bodies to a great extent; while, with common soap and water, the greatest portion of it might have been removed.

From the conflicting nature of the above testimonies, it is very evident most parties were but little informed on the subject. A little attention to the nature of the experiments will solve the difficulty.

An acid applied to a compound fluid must decompose it, unless an acid has already entered largely into the composition of the fluid. When a writing is, therefore, subjected to the action of an acid, and remains almost unchanged, we are warranted to conclude, that an acid must, at one stage of the manufacture, have entered into its composition. But acid, being the most destructive of all substances to an astringent black, as well as to the fabric of paper and cloth; it is not only credible that the same fluid, which stood the test of an acid, faded when exposed to the action of the atmosphere; but it is the very result which its indifference to the acid might have led Dr. Birkbeck and his hearers to expect. The less any of the fluids was effected by the application of an acid, the more likely

it was to contain a principle destructive of its ultimate black colour, and the fabric of the papers.

The value of such exhibitions might safely be left to the test of time and of ledgers, had their plausibility not misled many of those who manufacture writing inks, as well as those who use them.

It will be allowed, that none of the inks hitherto manufactured, have possessed the requisite qualities of blackness, fluidity, and anti-corrosion, arising, in many instances, from the slight knowledge of chemistry possessed by those who have manufactured them. Vegetable matter being at all times the principal portion of writing inks, the object of ink-makers is to destroy that portion which induces decomposition, without the remaining portion being impaired or injured; such being the case, recourse was had to acids, and other powerful drugs, which experience has shown to have entirely defeated their intentions, by destroying the permanent qualities of the ink.

I think the subject may now be said to be set at rest by a recent discovery of Mr. Dugald Murray, whose opportunities (being a practical, as well as an experienced chemist) of investigating and comparing the materials employed in writing inks of different ages, and who has devoted much time to the restitution and general improvement of an important, but long-neglected branch of British manufacture. Referring to a prospectus just issued by Mr. Murray to the London trade, the following occurs, which I take the liberty of extracting at full length :—

"ATRAMENTUM (PERMANEO).

"Mr. D. Murray, the inventer of the above celebrated writing ink, has been induced to offer it to the notice of the trade and the public, from a conviction in his own mind (after having tried by analyzation the various properties of the inks in use) that an ink was wished for which combined the various qualities of intense blackness at the moment of writing, perfect fluidity, anti-corrosion, and durability, and one that could be applied to every purpose for which writing ink is required, without their having recourse to the multitude of novelties in ink, by which the public are at present annoyed.

Mr. M. feels assured, that one trial will convince any person of the superiority of his "Atramentum (Permaneo)," which signifies an ink that will remain or be permanent—a quality which it possesses in an extraordinary degree; at the same time begs leave to state, that the cause of most inks discolouring, decaying, or becoming illegible after a short time, is the action of the atmosphere upon a portion of the vegetable matter used in making ink, which causes it to decompose while, in the "Atramentum," that portion is entirely destroyed by the admission of ingredients which Mr. Murray has never found to have been employed in any of the numberless inks which he has at various times analyzed."

By reference to that most to be relied on, of all works of reference, the "Encyclopœdia Britannica" will be found the following extract, which fully substantiates the foregoing statement of Mr. Murray:—

"Much as the subject of writing inks has of late engrossed the attention of the *literati* and the curious, we have never found any to possess the requisite qualities of permanence, fluidity, and anti-corrosion, to such a degree as "Murray's Atramentum," to which may be mainly attributed the popularity it has obtained."

The name of "Atramentum (Permaneo," appears to have been adopted by Mr. Murray, not from any desire for eccentricity, but merely to distinguish his ink from the legion of others in existence. The fair Capulet says,

What's in a name?

I answer, much, when a name (as in this instance) can be bestowed on an article which so fully bears it out.

I have to beg pardon for intruding so long on your valuable time; but having experienced great difficulty in obtaining ink at all to my satisfaction, and feeling that others have had the same, I considered the subject of sufficient importance for the length I have extended it to. I have another object in view, besides that of drawing your attention, and that of the public, to a very important discovery, that of endeavouring to show the necessity of inquiry into the media employed, by which the ideas of others, and the knowledge of by-gone generations are conveyed to us—that of writing, without which blessing we should be at once plunged into a state of almost savage barbarism. In the hope that Mr. Murray's invention may meet with the success which it merits, I beg leave to subscribe myself

Yours, most respectfully,

THOMAS MARTIN,
Accountant.

Wilmington Square, London.

LONDON JOURNEYMENS' TRADES' HALL.

A PUBLIC meeting of the working classes of the metropolis was held on Monday, March 9, at the Mechanics' Institution, Mr. Wakley, M. P., in the chair. The theatre, which will contain about 1,500 persons, was completely filled, but the greatest order was preserved, and the different speakers were listened to with unceasing attention. After a characteristic address from the chair, the secretary read to the meeting letters which he had received from Mr. Ewart, M. P., and Mr. Roebuck, the latter of whom had become a shareholder, pledging themselves to support the object of the meeting in every possible way. The report of the provisional committee was then read, of which the following is an abstract:—

"The object of a Trades' Hall is to prevent, as much as possible, the necessity of holding trade meetings at public-houses, and to afford a facility to all the lodges of the large trades in the metropolis to assemble together, on matters of importance, individually to themselves.

To economise the expense of trade societies, by providing them with better accommodation, at a lower rate of rental, than is at present paid by the majority; whether the same be in a fixed sum, or in a supposed adequate consumption of liquor during the hours of meeting.

To concentrate the London trades for the mutual protection and benefit of all; and, generally,

To promote the social and moral improvement of the working class.

A preliminary meeting of the friends of such an undertaking was convened by circular and advertisement, and held in Providence Hall, Finsbury Square, July 11, 1839, at which your provisional committee was appointed, and they immediately proceeded to an active discharge of their duties, by assembling weekly at the Suffolk Coffee-house, 16, Old Bailey. An address was immediately drawn up and forwarded to every trade society, as far as practicable, requesting their co-operation in maturing the proposed measure.

In reply to this address, the provisional committee had the pleasure of meeting with delegates from the following trades, lodges, and societies:—Tin plate Workers' Society, Bookbinders' Friendly Society (Lodge No. 1), City Division of Bootmakers, Camberwell Lodge of the Friendly Society of Carpenters, King's Arms Society of Carpenters, Ladies' Shoemakers, City Branch of the Amicable Society of Operative Plasterers, Manchester Society of Machinists and Engineers (Southwark Branch), Tobacco-pipe Makers, Operative Stonemasons, London Union of Compositors, Lodges 2, 7, 8, 13, and 14, of the Friendly Society of Carpenters, Goldsmiths' and Jewellers' Society for the Prevention of the Increase of the Hours of Labour, Anchorsmiths, Pianoforte Makers, Letter-press Printers, Operative Labourers' Society, Second Society of Carpenters, Hearts of Oak Society of Carpenters, Shoreditch Charter Association, Goldsmiths' and Jewellers' Friendly Society, Working Men's Association, and the North London Charter Association.

On meeting with these delegates, it became necessary to define minutely the design and constitution of the Trades' Hall Company. A prospectus, in a pamphlet form, was, therefore, promptly circulated among the trades' unions, lodges, and societies, as far as the same could be accomplished; yet, in the absence of correct information, it is feared that many of the trades of London have not yet been communicated with. The growing knowledge of such a company leads the provisional committee to hope, that the necessity of supporting it will naturally force itself on the best feelings of these bodies of operatives, and that in time their co-operation will be given and exercised in its behalf.

The design so published, embraced the erection of a large Hall, to accommodate from three to four thousand persons, in the centre of the metropolis, with numerous committee-rooms under the same roof; an extensive library and museum; the delivery of practical lectures; the establishment of schools for the cheap and liberal instruction of the children of operatives, and a refreshment establishment on the premises.

The result of those prospectuses has not been quite so effective as the provisional committee might have anticipated; yet they will not accuse the trades of London with apathy to the welfare of the working men who compose them; there does exist a growing desire to be released from the moral bondage which clings around the present system of trade meetings; and, while a mixture of prejudice and ignorance respecting the humble proposers of this plan must naturally exist among the great majority who toil, the provisional committee venture to believe, that prudential motives alone suggest the apparent lukewarmness of those united bodies of operatives; and they still hope, that after submitting the merits of a Trades' Hall before this tribunal, they shall succeed in

proving the sincerity of their zeal to promote its success among the mechanics of London, in whose hands they desire to commit its sole control and management.

The provisional committee have it in their power to announce, that the Tinplate Workers' Society, Goldsmiths' and Jewellers' Society for the Prevention of the Increase of the Hours of Labour, and North London Charter Association, have each come forward, in an early stage of the measure, to support it by taking shares, on which they have paid their respective deposits, and their delegates are, at the present time, among the most active members of the committee. Delegates are also in constant attendance with the provisional committee from the Southwark Branch of the Manchester Society of Machinists and Engineers, Lodges 7, 8, 13, and 14 of the Friendly Society of Carpenters, Second Society of Carpenters, King's Arms Society of Carpenters, and Working Men's Association, in each of which they are individually exerting themselves most zealously in obtaining shareholders.

The applications for shares in the Company now forming, amount to nearly 400, all of which proceed from working men, with two or three exceptions; and a great accession of strength is anticipated from the moral effects of this meeting, as numerous individuals have withheld their applications until this meeting shall have been held; and the provisional committee venture to dwell with satisfaction on the favourable results which a development of this noble plan this evening must produce in the minds of those for whose benefit and improvement it is peculiarly designed.

The provisional committee have long been feelingly sensible of the importance of investing the proposed Company with the utmost possible stability, that the respectability of its position, the liberality of its principles, and the extensive prospects of its benefits, might win for it the esteem and unceasing support of the working class. With this view, they early succeeded in securing the assent of Messrs. Prescott, Grote, and Co., to be its bankers, when the occasion for their services should arise. A code of laws for the constitution and government of the Trades' Hall Company have been prepared, and are now duly enrolled. The shareholders are under the shield of the law, which sanctions its progress and success, and a Trades' Hall wants, therefore, but the united energies and subscriptions of the working men of London to erect its walls, its roof, and an open door for their undisturbed use and benefit.

The provisional committee, in conclusion, while they ardently desire such a gratifying consummation of their plan, will hail with pleasure the opportunity of resigning their trust into other hands; the peculiar nature of their appointment by only a small body of friends, renders them doubly anxious to see the growing Company under the management of popularly elected individuals; and they hope soon to be able, in accordance with the laws of enrolment, to convene the first meeting of shareholders for that purpose; it will then be their duty to resign their present functions into the hands of the responsible Council of Forty-five, who will then be elected, and the provisional committee, no longer in existence, will retire from the honourable post which they have enjoyed during the last seven months, more disposed than ever to give their energies and intellects, in their respective spheres, to enhance the success and erection of the working man's best friend in London—A TRADES' HALL!"

The following resolutions were then agreed to; after which, the meeting was adjourned, to be held at the same place on the 11th of May:—

"1. That it is the opinion of this meeting, that the prevailing custom of holding trade meetings at public-houses throughout the metropolis, not only interferes with the good order and business of such meetings, but produces a prejudice against the moral character of the operatives of London, which is made to serve as a pretext for denying them their natural and political elevation in the scale of society.

2. That a central Trades' Hall, on an extensive and liberal plan, erected by, and kept constantly under the controul of the working men of London, is considered by this meeting as eminently calculated to secure to them a free and unmolested right of assembling and discussing at all times, and on all occasions. Embracing the convenience of the principal trades, and the political associations of the metropolis, the better government of their various meetings and societies would immediately follow; while a system of general concentration, and the intellectual improvement of the operatives, would permanently promote their moral and social welfare.

3. That the plan and object of an undertaking now in course of formation, under the title of the "London Journeymens' Trades Hall," having been submitted to this meeting, and fully considered; the same are deemed well adapted to promote the erection of such a building; and the

working men, but more particularly the trade societies of the metropolis, are earnestly advised to support the same in the most effectual manner.

4. That the hearty thanks of this meeting are eminently due to those trades and public-spirited shareholders who have already come forward to its support, and, by their energy and perseverance, effected the enrolment of the Company now forming, and the publication of an ample and liberal code of laws for its constitution and government."

We cannot flatter ourselves that all our readers will concur with our opinion on this subject, but we will nevertheless express it conscientiously, and without reserve—That the operative class, including all the numerous trades in this city and its neighbourhood, should combine as a community, for the purpose of promoting their mutual welfare, and that, in order to effect that object, they should possess a hall proper for the transaction of public business is much to be desired; because we are convinced, not merely by speculative reasoning, but by absolute experience and observation in other countries, that such combination, if properly conducted, would promote good fellowship among men, and afford assistance in distress, and good council in difficulties, which can only be partially and imperfectly obtained from less numerous, influential, and enlightened assemblies. A society was formed some years ago in Geneva, called the "*Reunion des Industries*," or meeting of the working classes; the first condition proposed, and to which they have ever since strictly adhered, was, that they should be perfectly independent of all persons of superior rank and fortune; and although they have the advantage of counting among their members, men whose scientific reputation extends over the whole civilized world; and although they have received gifts to a considerable amount, from those who have been deservedly favoured by fortune, still no individual possesses the power of controlling the affairs of the society, or has any claim upon the common property, beyond that which belongs to the humblest individual in the society. Notwithstanding the exclusiveness of these regulations, an excellent understanding exists between the government and the institution; and the latter has, upon various occasions, been consulted by the legislature, and the wishes of the society have been acceded to, and formed the bases of laws which especially concern the classes which the society represents.

This is the position which the working men of this country ought to occupy; but it can never be attained by an alliance with intriguing politicians, especially with a faction that seeks the dismemberment of the empire abroad, and the dissolution of its institutions at home. We do not wish to see the working classes "dreaded" by the rest of society, as recommended by Mr. Wakley, but we wish to see them respected, and in a position which must command respect. We do not wish to see the Trades' Hall usurp the power of the legislature, as advised by Dr. Bowring, because we conceive the professions of a respectable tradesman and a revolutionist to be incompatible. But even those who consider it convenient and proper to join political factions, must perceive the impolicy of allowing any party, foreign to the working class, the power of controlling the affairs of the institution; for should the shares rise in the market, they not only *might*, but most probably *would*, be sold to the best bidders, as is customary in *jobs* of this kind. Thus the members of the Institution, from being the tools of a clique of demagogues, might be made the slaves of an exactly opposite party. These and many other considerations induce us earnestly to recommend the working men of this city, *not to join the society upon the proffered terms*, but to meet together and discuss their own business without the assistance of any professional spouters whatever. If they cannot raise fifteen thousand pounds, let them be contented with fifteen hundred. Surely, if the undertaking were properly understood and appreciated, 1,500 men might be found willing to subscribe sixpence per week for a period of forty weeks; and then they would not only be independent of all external influence, but have an opportunity of discovering who are their *real* friends, as they would probably receive considerable donations in furtherance of their object, and that, perhaps from quarters where they least expected it. In conclusion, we strongly recommend the project of erecting a Trades' Hall; but consider it essential to its beneficial operation, that it should be the common property of the members; and, above all, that the acts and resolutions of the society should be such as would conciliate, rather than alarm the higher classes.

MR. JOHN BROWNE, THE LATE EMINENT ARTIST.

Full many a gem of purest ray serene,
The dark unfathom'd caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness in the desert air.'
GRAY.

IT is with sincere regret that we have to announce the decease of Mr. John Browne, a highly-talented artist, who expired, after a lingering illness, at his residence, Clarendon Square, Somers Town, on Saturday last, at the early age of 35, leaving a sister and niece, who were wholly dependant upon him, entirely destitute of the means of support. Mr. Browne ranked among the most rising artists of the day, and produced some delightful specimens of beautiful drawing. In proof of this assertion, we may instance "Finden's Tableaux;" "The Diadem," published by Smith and Elder; "The Book of Royalty," by Ackerman; Mrs. Howitt's "Birds and Flowers;" and various other productions of first-rate merit. It is a melancholy reflection to think of genius or talent, of a high order, fading and vanishing before us in its very prime. Mr. Browne was unquestionably, not to speak in terms of exaggeration, a man endowed with a fine sense of whatever is lovely or beautiful in nature; or otherwise he could not have imparted those exquisite touches, those delicate refinements, by which his works are distinguished, which minds alone of the nicest sensibility could conceive, and which could be accomplished only by the most fervid zeal. No man was more warmly esteemed or beloved, by those who enjoyed the pleasure of his intimacy, than this lamented gentleman. He was a generous friend, and an excellent man; of a benevolent disposition; and it may be truly said of him, in the words of Pope's epitaph upon Gay, that he was

In wit a man, simplicity a child.

It is hoped that the patrons of the fine arts, with their wonted liberality, will come forward and do something to mitigate the sorrow and distress in which the sister and niece are plunged by this afflicting event.—*Advertiser.*

[We recommend the above truly lamentable case to the especial notice of our readers. From our having been personally acquainted with the late Mr. Browne, we can conscientiously affirm, that the "*Advertiser*" has not said a word too much in his praise. We are happy to add, that a subscription is about to be raised on behalf of his bereaved relations.]

REVIEW.

The Traveller's Guide through England and Wales, and the Principal Part of Scotland; with the Railways, Canals, and Roads, laid down with great precision. Corrected to the present Year, according to the best Authorities.

A Geological View of the Mountains, Hills, and Remarkable Eminences of England and Wales. Compiled from the Papers of the Geological Society, and private sources. By the Rev. T. WILSON. London: Darton and Clark.

NO man should be without a map of his own country, especially at the present period, when it has undergone such considerable improvements by the introduction of railways through the various routes. The maps before us appear, as far as we have been able to examine them, to be executed with great care, and present at once useful and tasteful ornaments for the parlour or the study. We cordially recommend them.

THE CHEMIST.

CHEMICAL ANALYSIS.

To the Editor of the Mechanic and Chemist.

SIR,—If the following papers, which I propose to send on "Analysis," you should deem worthy of insertion in your valuable little journal (which I have not but till lately had the pleasure of perusing), you will confer a favour, perhaps, as well as to many young chemists who read your valuable periodical, as unto him who begs to subscribe himself

Your obedient servant,
MANIPULATOR.

ANALYSIS.

In treating, in a brief manner, on this important part of chemistry, I shall explain it in the following order:—1st. Analysis of gaseous mixtures; 2nd. Analysis, or separation of different metals, when combined in one ore or specimen; 3rd. The tests, &c., for the respective earths and metals. Having not much pecuniary means, I am obliged to make most part of my apparatus myself, which I shall describe to you; as, perhaps, some person in like circumstances may be benefitted by it.

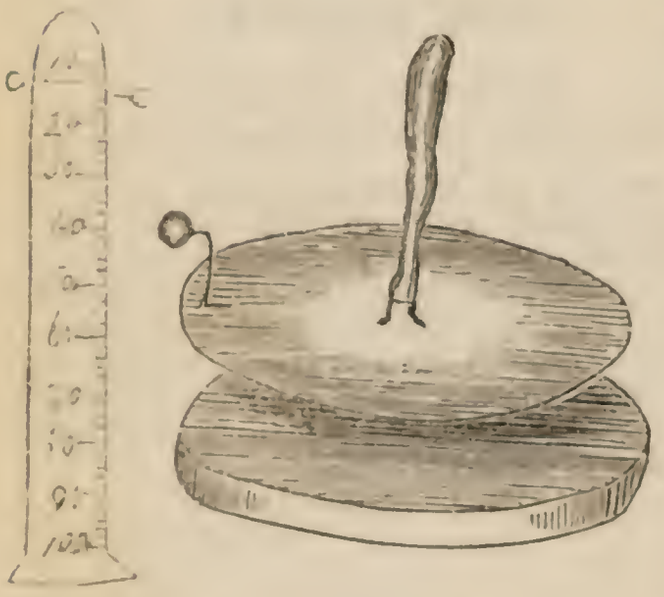
1st. *Analysis of Gaseous Mixtures containing Oxygen.*—This is performed by an instrument called Volta's endrometer, being the invention of Professor Volta.

Fig. 1 consists of a glass tube, closed at one end, and rather widened at the other, of about three-fourths of an inch in the bore. It is graduated and divided into 100 parts; through the closed end is inserted a piece of wire, having a small ball at each end.

In performing the analysis, a portion of air is measured in a graduated tube, which is generally done by means of the pneumatic trough; it is then mixed with a portion of hydrogen, which should be rather more than sufficient to unite with all the oxygen present. This mixture is then introduced into the endrometer; it is placed in a trough of either mercury or water the thumb is applied to the widened end of the tube; an electric spark is passed through, which causes immediate detonation. You then divide the total diminution in volume by 3, which indicates the quantity of oxygen originally contained in the mixture. Not having an electrical machine, I usually employ an electrophorus, which generally answers my purpose very well.

Fig. 2 consists of a tin dish (circular),

Fig. 1. Fig. 2.



filled with a composition of shell-lac and rosin; and another tin plate, made exactly to fit, with a socket on the top, to contain a glass handle. When wanted for use, it must be well warmed, and then quickly brushed over with a piece of flannel; the top plate is then put down. You touch it with your finger, lift it again, and apply the small knob on the upper plate to the wire of the endrometer.

Instead of electricity, spongy platinum is sometimes used; in this case, the hydrogen used should be kept for a few hours over mercury, in contact with a platinum ball, to free it from traces of oxygen, and a piece of caustic potassa to deprive it of moisture. The platinum balls may be made by mixing three parts of platinum to one of pipe-clay, made into a paste with water, and then rolled into a small ball; a little chloride of ammonia should be mixed with the paste, and when the ball is dry, ignited at the flame of a lamp. When the ammonia escapes, the ball also should be heated well before being used. It must be performed in a mercurial trough. If performed in a tube of the size I have given, the diminution arrives at its full extent in about eight minutes.

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 244).

TIN.—58.

Tin is a very ancient metal; it was known to Moses, and mentioned in the Book of Numbers. It was used by the Phœnicians, who obtained their ore from the mines of Spain and Britain. It was also known to the Egyptians, Greeks, and Romans. It is a very white and brilliant metal; hence it was called Jupiter by the ancients, from its brilliancy, being supposed to resemble that of the planet.

It is not oxidized by exposure to air. It is quite malleable, and is rolled out into thin leaves, called tin-foil, which is extensively used in the arts. It is used by dentists in plugging decayed teeth.

Tin may be distinguished from all other metals, by giving a peculiar crackling sound when bent. It melts at the temperature of 442°, and, when heated to whiteness in the open air, takes fire and burns with a splendid white flame, producing an oxide of this metal.

Tin is most extensively used in the arts, in combination with other metals. United with lead, it forms solder, used by the tin-plate workers in soldering their vessels. Common tin ware is made of plates of sheet-iron covered with a thin coating of metallic tin, prepared by dipping the sheets of iron, previously cleansed, into melted tin. Vessels made of this material, are sometimes called block-tin ware. Copper tea-kettles, and other vessels of the same metal used for domestic purposes, are covered on the inner surface with a coating of tin, prepared by first cleansing the surface of the copper, and then melting the tin in the vessel, a thin coating of which will adhere to the copper, and the rest, in a melted state, is poured off.

Exp.—Take a piece of sheet copper, and place on it a small bit of tin and a little powdered rosin, and hold it over a spirit

lamp, the flame of which melts the tin, and causes it to unite with the copper, and its surface becomes covered with metallic tin.

Block-tin vessels, such as tea-pots, coffee-urns, &c., are tin, containing about five or six per cent. of brass, and a small quantity of metallic antimony. The articles are cast in copper moulds, generally in pieces, and afterwards soldered together and polished.

Britannia ware is made of the same materials as the block-tin ware, except that, for the brass used in the block-tin, copper is here substituted. The articles are formed by first casting the metals into thin sheets, and then beating them up into the desired forms by hammers and other instruments.

There are two oxides of tin, the protoxide, and the peroxide. The latter is a pale yellowish powder, and is used in the arts, under the name of putty of tin, for polishing metals, and, when melted with red lead, it forms white enamel, of which watch and clock dials are made.

There are two combinations of tin and sulphur, called protosulphuret and bisulphuret; the latter has been known from the earliest ages, and has been used in the arts, under the name of Mosaic gold, to give a golden colour to bronzed and japanned work. The bronzed iron railings are frequently prepared by mixing this article with the paint when it is laid on. Sometimes they are painted, and then various bronzes are laid on afterwards.

LEAD.—104.

Lead is rarely, if ever, met with in the native state; but in combination, and especially with sulphur, it is an abundant natural product, called, by mineralogists, galena; but more commonly lead ore, as it is the only ore from which the metal is obtained.

The process for reducing the ore is exceedingly simple. The ore and common wood fuel are packed in alternate layers, in a furnace, and the wood set on fire, and by the combustion of it the sulphur is expelled, and the lead, in a melted state, runs into the bottom of the furnace, whence it is drawn off into moulds, where it cools, forming bars, which are called pigs of lead.

Lead has a bluish colour, and strong metallic lustre; but soon tarnishes by exposure to air. Its specific gravity is 11.38. It is malleable and ductile, and is so soft, that it may be scratched with the finger nail. Its malleability fits it for many purposes in the arts, in the form of sheet-lead. It melts at 612°, and boils at a red heat.

Lead is extensively used in the arts; with antimony, it forms the alloy of which types are made; with tin, it forms pewter; with a small quantity of metallic arsenic, it is used to make shot. The sheet-lead that lines the tea-chests, is made by pouring the melted metal on cold plates of iron or stone, in an inclined position, by which process a thin coating of metal is formed on the flat surface, and the remainder runs off, and is collected for another operation.

Lead is rapidly oxidized by exposure to heat and air; a yellow crust first appears on its surface, which, in common language, is called dross, but by the workmen and in commerce, massicot; it is the protoxide of lead, and, when pure, is of a lemon yellow colour; it combines with acids, forming salts. The sugar of lead consists of this oxide, combined with acetic acid.

Litharge is also an oxide of lead, prepared by heating massicot exposed to the air, from which it takes up an additional portion of oxygen. It consists of a mixture of the protoxide and deutoxide.

Common red lead is the deutoxide of lead, and is sometimes called minium. This compound, like the preceding ones, is prepared by heating the metal, or litharge, in contact with air; but requires a longer time for its formation. It consists of one atom of lead and one-and-a-half of oxygen, or it may be considered as composed of two atoms of lead and three of oxygen.

COPPER.—32.

Copper has been known from the earliest ages. An alloy of this metal with tin, formed the cutting instruments of the ancients. Their arms, and many of their domestic utensils, were made of this alloy. Copper, it is supposed, was discovered in the island of Cyprus; hence the word *cuprum*, which is the Latin name for copper. This metal is frequently found native, and it is, doubtless, owing to this circumstance, that it was so early known and employed in the arts.

Obs. A mass of native copper was found in the vicinity of Lake Superior, weighing 2,200 pounds. It is frequently found in masses of several pounds' weight.

Copper is readily distinguished from all other metals, except titanium, by its red colour. It receives a high metallic lustre by polishing. Its specific gravity, when fused, is 8.66, and may be increased by hammering. It is both malleable and ductile. It melts at a white heat, and, if freely exposed to air or oxygen, it burns

with a brilliant green flame. In dry air, copper undergoes little change, but moist air soon oxidizes it, forming a green crust upon its surface.

Copper is extensively used in the arts, both in a state of purity and in combination with other metals.

Obs. 1.—Pure copper is extended between iron rollers into thin sheets, which are used for covering the bottoms of vessels, and for making utensils of almost every description.

2. From its ductility it is drawn into wire, which is considerably used in the arts, and the strength of which is only inferior to that of iron.

3. *Brass* is an alloy composed of about three parts of copper and one of zinc, and is formed by melting the two metals together in a crucible.

4. *Bell-metal*, of which church bells are made, consists of an alloy composed of about four parts of copper and one of tin.

5. Common pins are made of brass wire, covered with a thin coating of metallic tin.

Oxides of Copper.—There are two definite compounds of copper and oxygen:—The first, or protoxide, is a native product, and is called by mineralogists ruby copper.

When copper is heated to redness in open vessels, it becomes covered with scales, varying in colour from a dark brown to a bluish black; this is the black oxide, and contains twice as much oxygen as the preceding compound. Calling the first the protoxide, this should be denominated the deutoxide.

There are two native compounds of copper and sulphur, the protosulphuret and bisulphuret; both have a yellow colour, and constitute the chief ores from which the metal is obtained. The first is called by mineralogists copper glance, and the second copper pyrites.

Dr. Turnbull.—About three weeks ago, a respectable mechanic, employed in her Majesty's Dockyard here, and his wife, having three children born deaf and dumb, applied to us for a letter of introduction to Dr. Turnbull, which we complied with, being anxious to test, to the utmost of our power, the effect of his wonderful discovery upon them. The mother and her three children accordingly waited upon the Doctor, at his residence in Russel Square, and were received with great kindness. After being a fortnight under his care, we are happy to say that they have returned home, and can now hear perfectly well. The eldest girl had been in eight hospitals, and under every species of treatment for her unfortunate malady, but without the slightest benefit. She can now, however, hear the ticking of a watch distinctly at a distance of ten feet. The other two children, being young, cannot comprehend the meaning of sound; but it is evident they have acquired the blessed faculty of hearing, and will ultimately reap the benefit of it, by being able to speak at no distant period. We are glad that we put Dr Turnbull's discovery to a severe test in this instance, as the parties being strangers both to us and to him, prevents the possibility of collusion, and fully establishes his claim as a benefactor of the human race. We visited several of his patients on Wednesday, and were truly astonished at the wonderful cure performed upon a boy about eight years of age, named Charles Davies, who, in an incredibly short space of time, can speak perfectly, having acquired the faculty of hearing in a most extraordinary manner, requiring to be seen by those who knew him previous to his being placed under the Doctor's care, before they could believe it possible to effect such a change.—*Woolwich Advertiser.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, March 25, G. H. Bachhoffner, Esq., on Chemistry. Friday, March 27, G. Bennett, Esq., on Oratory and the Drama. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 26, A. Morton, Esq., on Mechanics. At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 24, C. Clarkson, Esq., on Practical Education. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 24, —— Kite, on Elocution. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street.—Monday, March 23, the Rev. William Vidler, on the Natural History of Mammalia:—Sloths and Ant-eaters. At half-past eight precisely.

QUERIES.

How to make brown Windsor soap?

AN INQUIRER.

A good receipt for making Bengal lights? I have the following, but it does not burn well:—Saltpetre, 2½ oz.; sulphur, ½ oz.; finely powdered zinc, ½ oz., and the proper cases for them. Also the receipts for making coloured fires that will burn in cases? W. H. W.

1. How to make a dye for faded black silk? 2. How to preserve ginger? 3. How to make blue ink? R. S. M.

1. How to clean or repolish gilt frames? 2. The cheapest and best method to procure gold ink for printing, and how laid on the type?

A TYROGRAPHER.

1 How are the various patterns given to snuff boxes? 2. How are the best sort of snuff-boxes

polished or varnished, and what polish or varnish is used, with the manner in which the same is applied? 3. What is the scent used for perfuming Windsor soap? 4. What are the names, and quantities used of essential oils, &c., to produce a very delicious perfume? H. J.

In making experiments the other day with a galvanic trough, I found the following results to take place, which, if any of your correspondents will explain, you will greatly oblige J. J.

I filled two glasses with pure water, and connected the positive and negative ends of the trough, and the water in the glasses, with moistened thread, and immediately oxygen gas was disengaged at the extremity of the one, and hydrogen at the end of the other thread in the glass. Now what becomes of the hydrogen in the vessel where the positive wire is placed? Why does not oxygen appear in the other vessel in which the negative wire is placed?

Being in want of some mechanical drawings, well executed in Indian ink, &c., by hand (not prints), any of your correspondents possessing the same, and wishing to dispose of them, may meet with a purchaser, by addressing a letter, during the ensuing week (stating their description, &c., and where they may be viewed) as under.

For H. W., care of Mr. M'Millan, stationer, &c., Highbury, Islington.

The process gold bronze goes through after the metal is beat and ground, that gives it that bright and silky appearance, and makes it work so soft?

W. W.

The proportions of copper and silver used in making what is called jewellers' gold, and how to melt the same? How to make gold size?

H. B. B.

1. Where can I purchase the small pipes, such as are used in bird organs, ready made? 2. What is the construction of the pedometer? 3. What is the construction of the pocket barometer? (*Query, thermometer).* I have seen them at a barometer maker's in Museum Street. 4. Can you give a description of church organs as to construction? Where can I purchase a good second-hand compound microscope? Smuggins.

ANSWERS TO QUERIES.

"An Amateur Chemist." 1. Does the vinous fermentation always precede the acetous fermentation, or can the latter take place without the former? It was long supposed on the authority of Boerhaave, that the acetous is universally preceded by the vinous fermentation; but this is an error; for starch in the vats of the starch-maker and dough, form vinegar, without any previous production of wine; so, again, in certain solutions of saccharine matter, the acid is evidently generated without any alcoholic state of the fluid.

2. Is the cream of lime used by coal-gas manufacturers for the purpose of abstracting carbonic acid from the carburetted hydrogen, or to abstract carbon? Certainly not to abstract the carbon, excepting in the form of carbonic acid, with which it combines. It also absorbs the sulphuretted hydrogen.

3. *To Regulate the Flow of Gas through an Argand Burner.*—A stop-cock. I should say, the gas to be turned on until the light is at its maximum, which, of course, will be the quantity of gas required. J. Mitchell.

To take out Stains of Ink, Oil, and Grease from Books.—Oxymuriatic acid removes perfectly stains of ink; and should the paper require bleaching, the operation will answer both ends at the same time. Nearly all the acids remove spots of ink from paper; but it is important to use such as attack its texture. Spirits of salt, diluted in five or six times the quantity of water, may be applied with success upon the spot, and after a minute or two, washing it off with clean water, A solution of oxalic acid, citric acid, and tartaric acid, is attended with the least risk, and may be applied upon the paper and plates without fear of damage. These acids, taking out writing ink, and not touching the printing, can be used for restoring books where the margins have been written upon, without attacking the text.

Method of Reducing Deals to the Standard Hundred (that is, 120 of 12 ft. $1\frac{1}{2} \times 11$).—Set down the number of deals in 1st column, length in 2nd, breadth in 3rd, and thickness in 4th; multiply all these numbers together, and put down the product in column 5. Add up the various sums in column 5, and divide by 198, the quotient will be the answer.

N. D.	L.	B.	T.	
10	× 12 ft.	× 11 in.	× 2	= 2640
5	× 10	× 9	× $2\frac{1}{2}$	= 1125
7	× 14	× 9	× 3	= 2646
8	× 16	× 11	× 3	= 4224
				10635

198)10635(53
990

735
594

141

$\frac{141}{198} = \frac{8}{11}$ nearly.

H. Q. F.

Answer $53\frac{8}{11}$; that is, 0. 1. $23\frac{8}{11}$

I am a timber merchant, and that is the method I make use of; and the fractions of deals are always considered as so many elevenths. The first part of the query is not quite explicit enough, as you have not stated whether they are sold at per foot run or per foot square of two inches. They are never sold so in London.

W. Small.

To Restore Paper that is disfigured with Stains of Iron.—This may be done by applying a solution of sulphuret of potash, and afterwards one of oxalic acid. The sulphuret attracts from the iron part of its oxygen, and renders it soluble in the diluted acids.

Chlorate of Potash.—Chlorine is made by pouring hydrochlorie acid on half its weight of black oxide of manganese in a flask, then applying a gentle heat; the gas should be passed through a small quantity of water, in order to absorb any hydrochloric acid that may pass over; it should then pass into a solution of potassa, until the liquid is found by reddened litmus-pa-

per to be neutral. This liquid contains chlorate of potash and chloride of potassium, the former of which is much less soluble in cold water, and therefore crystallizes, while the chloride remains in solution.

I doubt, however, whether this salt can be prepared at much less cost than its price; as when manufactured on the large scale, the residues of this operation can be applied to other purposes. J. J. F.

To Erase Spots of Grease, Wax, Oil, &c.—Wash the part with ether, and place it between white blotting-paper; then with a hot iron press above the parts stained, and the defect will be as speedily removed. In many cases, where the stains are not bad, rectified spirits of wine will be found to answer the purpose.

P. Amer.

To make Red Ink for Marking Linen.—Vermilion, half an ounce; salts of steel, one drachm; let them be finely levigated with linseed oil to the consistency required for the use of types, hair pencils, or pens. H. B. B.

TO CORRESPONDENTS.

O W.—*Several methods of making ginger beer have been published in "The Mechanic." In No.* 113, *there are two valuable receipts*, viz., Instantaneous Ginger-Beer. *Fill a bottle with pure cold water, then have a cock ready to fit it; also a string or wire to tie it down with, and a mallet to drive the cork, so that no time may be lost; now put into the bottle sugar or syrup, to your taste, and a teaspoonful of good powdered ginger; shake it well, then add the sixth part of an ounce of supercarbonate of soda; cork rapidly, and tie down—shake the bottle well—cut the string—the cork will fly—then drink* ginger beer.

Ginger-Beer Powders.—*Ginger powder, 1 drachm; carbonate of soda, 7 drachms; powdered white sugar, 3 ounces; essence of lemon, 25 drops. This quantity to be well mixed, and divided into twelve powders, or papers; each paper to be accompanied with 25 grains of tartaric acid in a separate paper.*

R. E. W. *wishes to know how to solder brass to tin, brass to brass, tin to tin, and iron to either of the former. The tin solder used by tin workers, will answer for all the above purposes; but, when iron or steel is to be soldered to brass or tin, sal ammoniac must be used instead of resin. If greater strength is required in soldering iron to brass, or brass to brass, silver solder or spelter may be employed, with borax for the flux. The back Numbers of "The Mechanic" may be procured at the publisher's.*

Adolescentulus.—*Specific gravity is the weight of a body of given bulk; thus the weight of a leaden bullet is greater than that of a marble of the same size; it is, therefore, said to be* specifically—*that is to say, in* specie, *or kind, heavier than the marble.*

J. B——n.—*The barometer is not subject to so great fluctuations in the high northern and southern latitudes, as are observed in the tropical regions, for reasons already explained. It seldom or never descends below* 28 *inches in high latitudes. The atmospheric pressure is not affected by local temperature; but a higher column of mercury will be sustained at a high, than at a low temperature, because the heated metal is specifically lighter than when cold. The cause of the falling of the mercury, at an increased temperature, was probably, as before intimated, owing to the presence of a small quantity of air above the mercury. It is true, as our correspondent remarks, that the same absolute weight is sustained, under all circumstances, of expansion and contraction, if the whole quantity remain in the tube; but the capacity of the tube being increased, that weight is incumbent on a larger surface of the reservoir, and the column of mercury is lower than it would be if the glass did not expand: the equilibrium is, therefore, restored by the mercury being forced up the tube from the reservoir, by the superior pressure of the atmosphere, and when the temperature is lowered, the contrary takes place, and a portion of the mercury is discharged into the reservoir. In all cases, the height of the column sustained by a given pressure of the atmosphere, varies directly as the expansion; or, which is equivalent, inversely as the specific gravity of the metal. This explanation will correct an error which our correspondent has pointed out in our last Number.*

Melek Ric.—*We shall be glad to see the papers he offers; if of a practical nature, they may be useful to many of our readers. His queries shall be attended to.*

G. S.—*The address is,* 33, *Navigation Street, Birmingham.*

Hodge's *Garden pots are of no utility whatever.*

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No. 84, NEW SERIES. | SATURDAY, MARCH 28, 1840. PRICE ONE PENNY. | No. 205, OLD SERIES.

OPTICAL INSTRUMENTS.

FIG. 1.

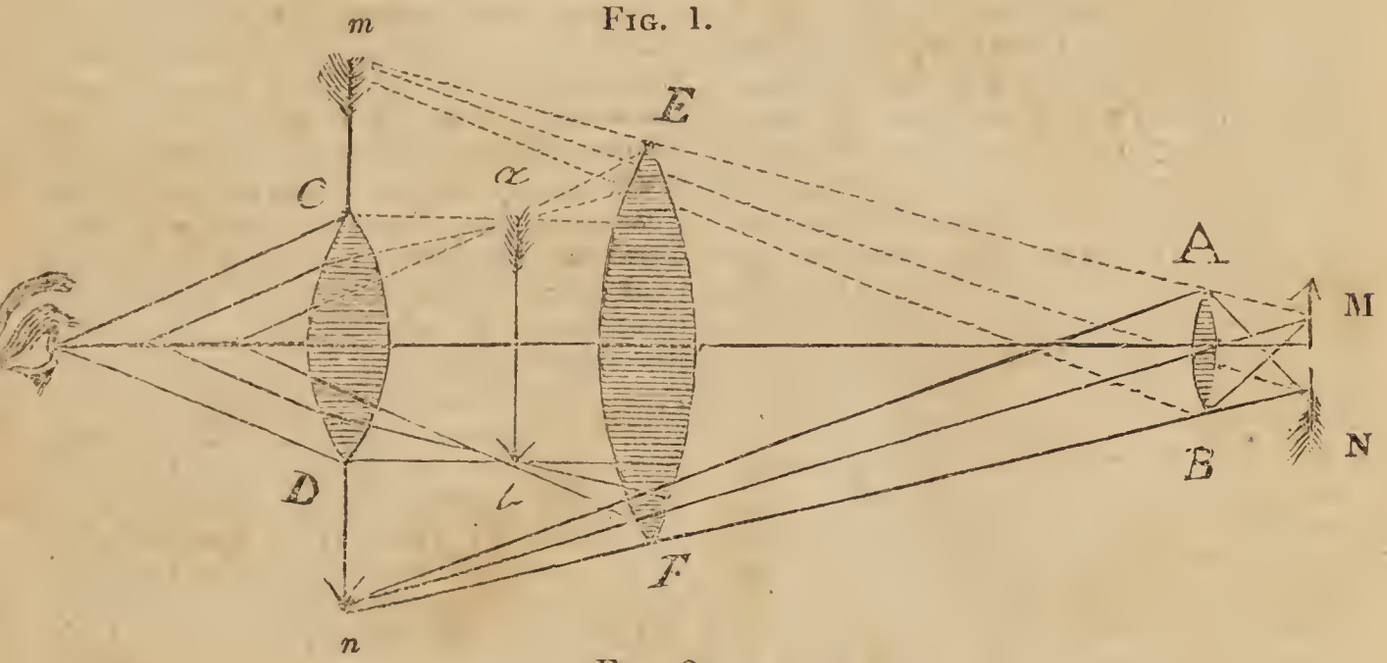
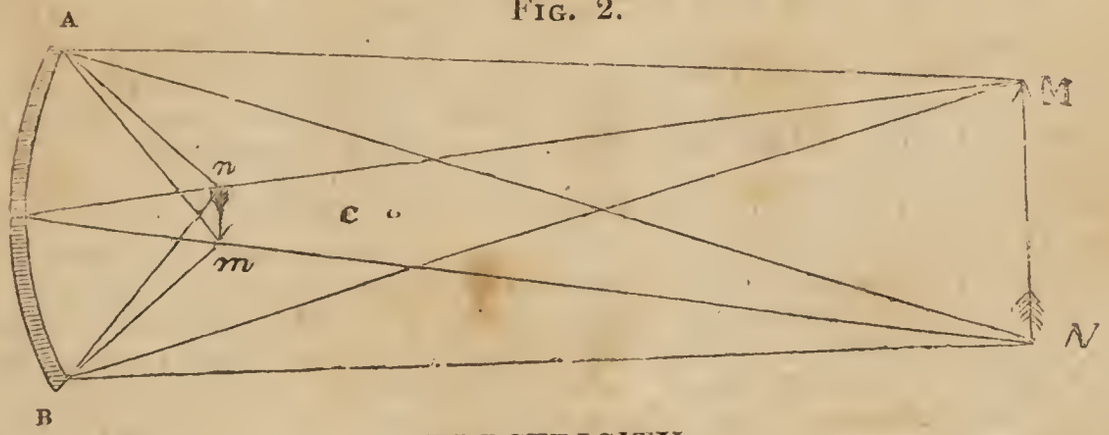


FIG. 2.



ELECTRICITY.

FIG. 1.

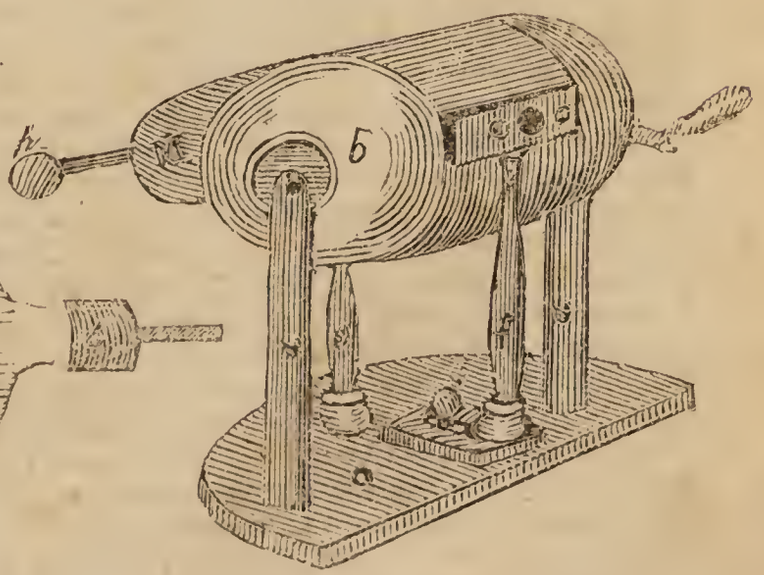
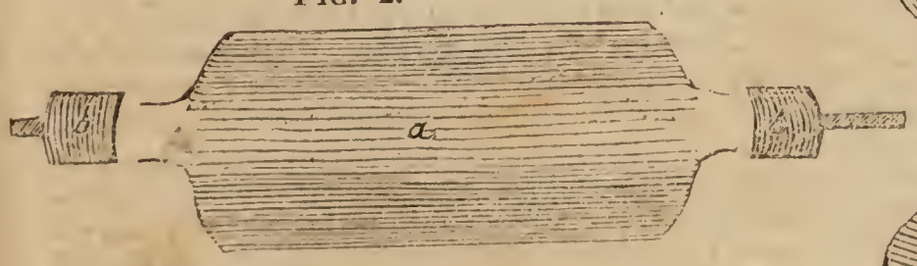


FIG. 2.



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OPTICAL INSTRUMENTS.

NO. VII.

(See Engraving, front page.)

COMPOUND MICROSCOPES.

When a microscope consists of two or more lenses or specula, one of which forms an enlarged image of objects, while the rest magnify that image, it is called a compound microscope. The lenses, and the progress of the rays through them in such an instrument, are shown in fig. 1, where A B is the object glass, and C D the eye glass. An object, M N, placed a little farther from A B than its principal focus, will have an enlarged image of itself formed at *m n*, in an inverted position. If this enlarged image is in the focus of another lens, C D, placed nearer the eye than in the figure, it will be again magnified, as if *m n* were an object. The magnifying effect of the lens, A B, is found by dividing the distance of the image, *m n*, from the lens, A B, by the distance of the object from the same lens; and the magnifying effect of the eye glass, C D, is found by the rule for single microscopes; and these two numbers being multiplied together, will be the magnifying power of the compound microscope. Thus, if M N is a quarter of an inch, and C *n* half an inch (*m n* being supposed in the focus of C D), the effect of the lens, A B, will be 20°, and that of C D 10°, and the whole power 200°. A larger lens than any of the other two, called the field glass, and shown at E F, is generally placed between A B and the image, *m n*, for the purpose of enlarging the field of view. It has the effect of diminishing the magnifying power of the instrument, by forming a smaller image at *a b*, which is magnified by C D.

The ingenuity of philosophers and of artists has been nearly exhausted, in devising the best forms of object glasses and of eye glasses for the compound microscope. Mr. Coddrington has recommended four lenses to be employed in the eyepiece of compound microscopes; and along with these he uses, as an object glass, the sphere excavated at the centre, as shown in fig. 3, page 199, for the purpose of reducing the aberration and dispersion. "With a sphere," says he, "properly cut away at the centre, so as to reduce the aberration and dispersion to insensible quantities, which may be done most completely and most easily, as I have found in practice; the whole image is perfectly distinct, whatever extent of it be taken, and the radius of curvature of it is no less than the focal length; sothat one difficulty is entirely removed, and the other, at least, diminished to one-half. Besides all this, another advantage appears in practice to attend this construction, which I did not anticipate, and for which I cannot now at all account. I have stated, that when a pencil of rays is admitted into the eye, which, having passed without deviation through a lens, is bent by the eye, the vision is never free from the coloured fringes produced by eccentrical dispersion. Now, with the sphere, I certainly do not perceive this defect, and I therefore conceive, that if it were possible to make the spherical glass on a very minute scale, it would be the most perfect simple microscope, except, perhaps, Dr. Wollaston's doublet. Now the sphere has this advantage, that it is more peculiarly fitted for the object glass of a compound instrument, since it gives a perfect distinct image of any required extent, and that, when combined with a proper eyepiece, it may, without difficulty, be obtained for opaque objects." The difficulty of making the spherical glass on a very minute scale, which Mr. Coddrington here mentions, and which is by no means insurmountable, is entirely removed by substituting a hemisphere (fig. 1, page 199), and constructing the aperture in the manner there mentioned.

Dr. Wollaston's microscopic doublet consists of two plano-convex lenses, with their plane sides turned towards the object. Their focal lengths are as 1 to 3, and their distance from $1\frac{4}{10}$ to $1\frac{1}{2}$ inch, the least convex being next the eye. The tube is about six inches long, having at its lower end a circular perforation about three-tenths of an inch in diameter, through which light radiating is reflected by a plane mirror below it. At the upper end of the tube is a plano-convex lens, about three-fourths of an inch focus, with its plane side next the observer; the object of which is to form a distinct image of the circular perforation, at the distance of about eight-tenths of an inch. With this instrument Dr. Wollaston saw the finest striæ and serratures upon the scales of the lepisma and podura, and upon the scales of a gnat's wing. Double and triple achromatic lenses have been lately much used for the object glasses of microscopes. In applying the compound microscopes to the examination of objects of natural history, it is best to immerse the object in a fluid for the purpose of expanding it, and giving its minute parts their proper position and appearance. In order to render this method perfect, it is proper to im-

merse the anterior surface of the object glass in the same fluid which holds the object; and if we use a fluid of greater dispersive power than the object glass, and accommodate the interior surface to the difference of their dispersive power, the object glass may be made perfectly achromatic.

Reflecting Microscopes.—The simplest of all reflecting microscopes is a concave mirror, in which the face of the observer is always magnified, when its focus is more remote than the observer. When the mirror is very concave, a small object, *m n*, will have a magnified picture of it formed at M N; and when this picture is viewed by the eye, we have a single reflecting microscope, which magnifies as many times as the distance, A *n*, of the object from the mirror is contained in the distance, A M, of the image. But if, instead of viewing M N with the naked eye, we magnify it with a lens, we convert the simple reflecting microscope into a compound reflecting microscope, composed of a mirror and a lens. This microscope was first proposed by Sir Isaac Newton, and after being long in disuse, has been revived in an improved form by Professor Amici de Modena. He made use of a concave ellipsoidal reflector, whose focal distance was $2\frac{4}{10}$ inches. The image is formed in the other focus of the ellipse, and this image is magnified by a single or double eye-piece, eight inches from the reflector. As the object cannot be illuminated when situated as in fig. 2, Professor Amici placed it without the tube, or below the line, B N, and introduced it into the speculum, A B, by reflection from a small plane speculum placed between *m n* and A B, and having its diameter about half that of A B. Dr. Goring (to whom microscopes of all kinds owe so many improvements), has greatly improved this instrument. He uses a small plane speculum, less than one-third of the diameter of the concave speculum, and employs the following specula of very short focal distances:—

Focal Distance in Inches.	Aperture in Inches.
1.5	0.6
1.0	0.3
0.6	0.3
0.3	0.3

Dr. Goring also has the merit of having introduced test objects, or objects whose texture or marking required a certain excellence in the microscope to be well seen. The most difficult of all the test objects, are those in the scales of the podura and the cabbage butterfly.

Rules for Microscopic Observations.—1. The eye should be protected from all extraneous light, and should not require any of the light which proceeds from the illuminating centre, excepting what is transmitted through, or reflected from the object.

2. Delicate observations should not be made when the fluid which lubricates the cornea is in a viscid state.

3. The best position for microscopical observations, is when the observer is lying horizontally on his back. This arises from the perfect stability of his head, and from the equality of the lubricating film of fluid which covers the cornea. The worst of all positions is that in which we look downwards vertically.

4. If we stand straight up, and look horizontally, parallel markings or lines will be seen most perfectly when their direction is vertical; viz., the direction in which the lubricating fluid descends over the cornea.

5. Every part of the object should be excluded, except that which is under immediate observation.

6. The light which illuminates the object, should have a very small diameter. In the daytime, it should be a single hole in the window-shutter of a darkened room, and at night an aperture placed before an Argand lamp.

7. In all cases, particularly when high powers are used, the natural diameter of the illuminating light should be diminished, and its intensity increased by optical contrivances.

8. In every case of microscopical observations, homogeneous yellow light, procured from a monochromatic lamp, should be used. Homogeneous red light may be obtained by coloured glasses.

Solar Microscope.—The solar microscope is nothing more than a magic lantern, the light of the sun being used instead of that of a lamp. The tube, A B, fig. 2, page 135, is inserted in a hole in the window-shutter, and the sun's light reflected into it by a long plane piece of looking-glass, which the observer can turn round to keep the light in the tube, as the sun moves through the heavens. Living objects, or objects of natural history, are put upon a glass slider, or stuck upon the point of a needle, and introduced into the opening, C D, so as to be illuminated by the sun's rays concentrated by the lens, A. An enlarged and brilliant image of the object will then be formed on the screen, E F.

A. D. M.

ON ELECTRICITY.

NO. I.

THIS highly interesting and important branch of science, the principal phenomena of which we are about to consider, is by no means of ancient date. Our ancestors certainly were acquainted with a few facts; they had observed the property which amber possessed, when excited, of attracting light bodies. From the Greek name, ηλεκτρον (electron), the word electricity is derived. They had also experienced the sudden and, no doubt, somewhat alarming effects of too close an approximation to the torpedo, or electrical eel*; but it appears that these, with one or two other facts, were probably all they knew, and the extent of their observations. Nor, indeed, was there much progress made in this science till the seventeenth century had dawned. In that era our stock of information certainly began to increase; but with tardy steps and slow, Newton, Dr. Gilbert, and some others at this period, contributed to its advancement: but it was only in the eighteenth and present century, that this science has made such rapid strides to the state of perfection in which we find it, and its connexion with other branches of science been pointed out. "Twenty-five years ago," says Professor Brande, in one of his lectures delivered at the Royal Institution, "it would have been difficult to observe any connexion between electricity and chemistry; but so great have been the advances made of late in this branch of philosophy, that it is now pretty generally admitted, that not only the main phenomena evidenced in chemical action are due to it, but there is scarcely any chemical change effected, in which electricity is not connected." Galvanism, a peculiar form of electricity, and electro-magnetism, have likewise, in this era, made their appearance.

The object of the following elementary treatise is, to consider the phenomena or principal facts connected with electricity, each of which will be illustrated with familiar experiments, intended chiefly for those who have hitherto had little acquaintance with the subject, and are anxious to do so.

The manner in which electricity is collected in large quantities, is by means of an electrical machine; and as, without it, no experiments but those which are on a small scale can be conducted, we shall commence with describing it.

If a tube of glass, a stick of sealing-wax or sulphur, previously warm and dry, be rubbed with a piece of dry flannel or silk, it will exhibit signs of electricity, or, in other words, be excited; and it is upon this principle that the electrical machine is constructed; all that has to be done being to collect the fluid contained by excitation, and prevent its being dissipated. Without entering upon a history of this machine, it will be enough to state, that at present there are two forms in which they are constructed—the one with a hollow cylinder, the other with a plate of glass. Opinion varies as to which of these preference should be given, some choosing one, and some the other; although the latter appears to be the most powerful. The former alone, however, we shall describe, as it will be sufficient for our present purpose.

The electric (or substance capable of being excited) generally used, is a cylinder of polished glass; they are made of all sizes, but one for actual service should not be less than ten inches in diameter; they are, however, made much smaller than this, and, for experiments on a small scale, answer very well. The appearance of the cylinder, as it comes from the hands of the manufacturer, is represented by the annexed figure, *a*.

Two brass caps,* *b b*, are firmly cemented on each projecting end, as high as the shoulder of the glass, both furnished with an axle, revolving in sockets fixed in the two upright pillows; *a a*, fig. 1, of baked mahogany or fir; the latter, if coated with shell-lac varnish, is to be preferred. The axle, or right-hand side, should be double the length of the other, in order that a handle, *s*, to set the machine in motion, may be attached. The caps, and, indeed, both ends of the cylinder, should be covered with a thin coating of sealing-wax, by dissolving it in rectified spirits of wine with heat, and applying it while hot by means of a brush. This is done for the purpose of rendering it completely insulated, otherwise the brass caps, being good conductors, would be apt to carry away a great

* Five of these animals were presented by Mr. Hawkins, of Berlin, towards the close of last year, to the London Electrical Society; but they unfortunately died on the voyage.

* I have been thus concise, because I know that there are many amateur mechanics who would purchase a cylinder and make the remainder of the machine themselves, if the method was described, as a high price is generally charged for philosophical instruments. Cylinders may be purchased at Wests's, in Fleet Street, or Palmer's, Newgate Street.

part of the electricity, which it is our object to accumulate.

A very good cement for fixing the brass caps to the cylinder, and also the glass pillars in their sockets, is made by melting together two pounds and a half of yellow resin with half a pound of bees' wax, to which must be added, while hot, half a pound of red ochre, and one tablespoonful of plaster of Paris; these two powders should be well mixed together before they are added to the mixture, into which they should be stirred till cold.

The rubber is the next part of the machine which requires our attention. It consists of a piece of hard wood, *c*, extending about three parts the length of the cylinder, to the bottom of which is affixed a brass tube, *e*, two or three inches long, into which the glass pillar, *f*, is cemented. A cushion is attached to the inner surface of the wood, to the upper part of which is sewed a thin piece of oiled silk, *d*, which should pass over the glass cylinder to within half an inch of the points of the conductor on the opposite side; the object of this is, to prevent the escape of the electricity till it has arrived at the row of points. The cushion is generally made with soft leather, stuffed with wool or horse-hair; sometimes India-rubber is used, covered with leather, as, on account of its elasticity, it will better adapt itself to the inequalities generally found on the surface of the glass, and cause a more equal pressure.

To the socket, in which the lower end of the glass pillar which supports the rubber is cemented, is attached a piece of mahogany, *l*, at right angles with it, having a groove cut down the middle, through which the screw, *h*, fixed in the base of the machine, passes. The rubber can thus be brought nearer or farther from the machine, as circumstances may render necessary; the screw keeping it in the situation required. This will readily be seen by inspection: fig. 1, a brass ball, *r*, is generally attached to the back of the rubber, for the purpose of collecting negative electricity.

On the opposite side of the machine to that on which the rubber acts, is placed, in a direction parallel to the cylinder, the conductor, M; the object of this is to collect the electricity as it is accumulated on the cylinder; for that purpose it is furnished with a row of pointed teeth on the side nearest the cylinder, about half an inch long, similar to those of a rake, placed three quarters of an inch apart, and extending the same width as the rubber. It consists of a long hollow cylinder, generally made of tin, rounded at each end, japanned and polished; sometimes a block of wood is used, rounded in a similar manner, and covered with tinfoil or gold leaf. The great thing in their construction is, to let them be perfectly smooth, free from all points and angles, as it tends to dissipate the charge. It is supported on a glass leg, attached to the base of the machine. Several holes, about the size of a quill, are bored into it, in order to fix any apparatus for the purpose of experiment; in one of which, generally the farthest from the cylinder, a metallic rod, carrying a brass ball, *p*, is inserted, and from which the jars, *d c*, are charged.

(To be continued.)

REVIEW.

Parley's Tales about Great Men. S. Lingham, Gray's Inn Road.

A VERY neat, as well as a very useful volume, with engraved portraits and frontispiece. We have perused it with a great deal of pleasure, and shall place it in the hands of our children with the full conviction, that no juvenile biographical work is better, if so well adapted to furnish their young minds with so just an acquaintance with some of the greatest men that have ever adorned our country The intelligent author remarks in his preface .—

"I am going to relate a few tales about a few great men—that is, men who have been deservedly famed for their eminent knowledge in various departments of science and literature, or singularly successful in advancing the best interests of their fellow-men. I wish to encourage you to believe that what others, who were once as young as yourselves, have done, you may also do; since they attained the elevated position and attendant honours, which in after life they enjoyed, by the same means which are at your own command, viz., by persevering industry and application."

We should be happy to prolong our remarks, did our space permit; we shall content ourselves, therefore, with an extract:—

"Rubens was possessed of all the ornaments and advantages that render a man worthy to be esteemed or courted, and he was always treated as a person of consequence. His learning was universal. He spoke several languages perfectly, and was an excellent statesman. Though his favourite study must have occupied the

chief of his time, yet he had read the works of the most celebrated authors, and especially the poets. He was of a noble and commanding aspect, engaging in his manners, and lively in his conversation.

While at Paris, Rubens became acquainted with the Duke of Buckingham, who so much admired his great talents and accomplishments, that he entrusted him with a commission of high importance, in which Rubens acquitted himself with such propriety, that he was afterwards appointed envoy to the King of Spain, to propose terms of peace. Philip, who then filled the throne, conferred on him the honour of knighthood, made him secretary to his privy council, and commissioned him to negociate a peace between himself and Charles I. Rubens accordingly passed over into England, and was received by the king with every mark of respect. He was successful in his negociation, and a treaty was concluded; but Charles I., aware of his high attainments as a painter, engaged him to adorn some of the apartments of Whitehall, and the completion of this work detained him some time in England. When he had finished his undertaking, the king gave him a handsome sum of money, and, as an acknowledgment of his merit, created him knight; the Duke of Buckingham, his friend and patron, also purchased of him a collection of pictures, statues, medals, and antiques, for the sum of 10,000*l.*, and he returned to Spain, where he was magnificently honoured and rewarded for his services.

Rubens, however, was a painter still, notwithstanding all the riches he had accumulated. The love of the art seemed to be with him as an innate principle; to constitute, as it were, a part of his very being, and he could not rest contented or happy with anything short of his favourite employment. He returned to Antwerp, where he married a second wife, and where he lived in great splendour. His house was enriched with everything in the arts that was rare and valuable. It contained one spacious apartment in imitation of the rotunda at Rome, adorned with a choice collection of pictures. His genius qualified him to excel equally in everything that can enter into the composition of a picture. His invention was so fertile, that if he had occasion to paint the same subject several times, his imagination always supplied him with something striking and new. He is, by all, allowed to have carried the art of colouring to the highest pitch. His pencil is mellowed, his strokes bold and easy, and his drapery simple, grand, and broad, and hung with much skill.

Rubens continued to follow his profession till his death, which occurred in the 63rd year of his age, at Antwerp. He left vast riches to his children; and Albert, his eldest son, succeeded him in the office of Secretary of State, in Flanders.

But though he has been long dead, his great performances yet speak. The grand compositions of Rubens are intended to be viewed at a distance, and he has, therefore, laid on a proper body of colours with uncommon boldness, and fixed all his tints in their right places; so that he never impaired their lustre by breaking or torturing them, but touched them in such a manner, as to give them a lasting force, beauty, and harmony.

Rubens is the first among painters eminent for pomp and majesty; the first among those who speak to the eye; and the power of the art is often carried by him almost to enchantment."

SHOREDITCH CHEMICAL SOCIETY.

To the Editor of the Mechanic and Chemist.

Sir,—I beg to inform you, that it is intended to open the Chemical Society in Shoreditch, on Wednesday evening next, 25th of March, at the infant schoolroom, No. 236, High Street, Shoreditch, with an introductory Lecture on Chemistry, to commence at eight o'clock. Admittance free, which will give an opportunity to persons so disposed, to join and co operate in the formation of the above Society. Accept, sir, of my thanks for your prompt insertion of my former note, by which a number of individuals have expressed their approbation of such a society, and their willingness to join the same.

I remain yours, &c,

Rob. Smith Jeffs. jun.

81, Shoreditch.

[This communication arrived too late for insertion in our last, and, consequently, it will not appear in time for the announcement of the *first* meeting. We wish success to the Society, and shall be always ready to promote its interests.—Ed.]

MISCELLANEA.

Method of Turning Wool into Fur.—The wool growers of Podolia and the Ukraine, and particularly in the Asiatic province of Astrachan, have a peculiar method of turning wool into fur. The lamb, after a fortnight's growth, is taken from the ewe, nourished with milk and the best

herbage, and wrapped up as tight as possible in a linen covering, which is daily moistened with warm water, and is occasionally enlarged as the animal increases in size. In this manner the wool becomes soft and curly, and is by degrees changed into shining beautiful locks.

The Knubut, or Great Flower of Sumatra, was discovered by Dr. Arnold in 1818. It is one of the most extraordinary of vegetable productions. It is a parasite, growing in the woods on the roots and stems of those immense climbing plants, generally of the genus *Vitis*, which are attached, like cables, to the largest trees in the forest. The flower constitutes the whole of the plant, there being neither leaves, roots, nor stems. It is a true parasite, growing out of another plant in the manner of the misletoe, and not on the decayed surface of the plants, as the common fern on the trunks of the old oak pollards. The flowers are of one sex. The growth of a full-grown flower exceeds three feet; and the petals or blossom leaves are of a subrotund shape, and measure twelve inches each from the base to the apex. That part which is considered the nectarium, and situated in the centre of the flower, would hold twelve pints of water; the pistils are as large as cows' horns, and the weight of the whole is calculated at about fifteen pounds.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 1, G. H. Bachhoffner, Esq., on Chemistry. Friday, April 3, G. Bennett, Esq., on Oratory and the Drama. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, April 2, A. Morton, Esq., on Mechanics. At eight o'clock.

Poplar Institution, East India Road.—Tuesday, March 31, Albert Smith, Esq., on the Ancient Sports and Pastimes of the People of England. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 31, J. Gay, Esq., on Physiology. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street.—Monday, March 30, the Rev. William Vidler, on the Natural History of Mammalia:—Animals which Chew the Cud. At half-past eight precisely.

QUERIES.

1. Why is the apparent brightness of a star increased by the use of a telescope, while that of a planet is not? 2. Why are some stars visible only at particular seasons of the year? 3. How the apparent place of a star, at any time, is calculated from its mean place at the beginning of the year? V. KNOX.

There was an occultation of the star α Lionis by the moon; the time for Greenwich was 7 h. 10 m. immersion, and 8 h. 21 m. emersion; would there be any difference, and what the difference, between the time at Greenwich, and in 50° 36′ north latitude, and 2° 27′ west longitude?
Weymouth. S. C.

A method of extracting the smile from oil, without deteriorating its properties? F. M.

Will steam, issuing from a high-pressure boiler, scald the hands at the orifice of the valve, when the pressure is equal to 80 or 100 pounds upon the square inch; and if not, why? C. S. Z.

What do the rat-catchers use to draw rats from their holes; also the ingredients it is composed of, and where I can procure them? T. A.

To make copal varnish, such as is used for coach-bodies? I have tried, but not succeeded; for when I put hot oil to the gum, it would not incorporate with the oil. Also, how to make linseed oil colourless? And what acid is as a drier instead of litharge? G. H.

[To make linseed oil colourless, try animal charcoal. If the oil be heated and strained through a layer of that substance pounded, it will, if we mistake not, come out nearly colourless.—ED.]

1. How to make the essence of peppermint? 2. How to make the best scouring liquor? 3. How to make the best Congreve matches? 4. How to make oil paper for blacking? 5. A simple method of filtering or purifying water? 6. A cheap method of making good paste for furniture? O. W.

The method of rendering the interior of a tub water-tight by some cement? What method of making a galvanic battery is the easiest or preferable? MELEK RIC.

[The other question is not intelligible.—ED.]

The kind of varnish or size used in printing with gold, and the cheapest way to make the same? To dye the hair auburn colour? Also to take stains out of cloth without injuring the colour? H. T. B.

The process of cutting and gilding the edges of paper, and the materials required? C. R.

How must I draw a block on which all the primary sun-dials may be drawn, viz., a horizontal dial, and direct E. W. N. and S. dials; also four direct inclining, and four direct reclining dials, together with the easiest and most accurate method of drawing all the above dials? What I most particularly want to know is, the correct method of cutting the block, so that the shadow may fall exactly on the same hour line of every dial that the sun shines upon at the same time. S. H. J.

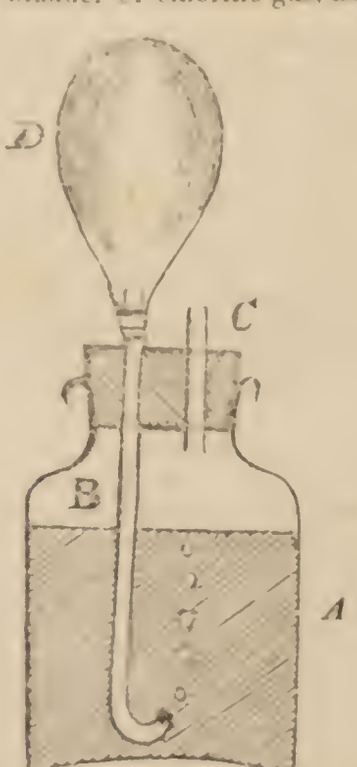
When an insulated metallic cylinder, furnished in different parts with pairs of suspended pith balls, is brought into the vicinity of an electrified globe of glass, all the balls, except those situated about the middle, will immediately diverge, &c. I should be glad to know, of what length the cylinder should be made, how the balls are to be attached to it, by what conducting substance they should be suspended, whether thread or wire, and by what means a globe of glass is to be sufficiently electrified to insure the success of the experiment? Would a tin cylinder do? and if so, is it better for being varnished in the same manner as conductors of electrifying machines are?
T. B.

1. Which is the newest and most improved work on practical mensuration, containing rules for measuring all kinds of superficies, solids, work of artificers, with algebra, logarithms, &c.? Also the cheapest and most approved work on practical and commercial book-keeping, containing the latest improvements in keeping merchants and bankers' accounts, &c.? 2. A receipt for making the best kind of varnish blacking for boots and shoes, that will produce a beautiful and durable jet polish? 3. A receipt for making the improved kind of matches, called Congreve fusees, which are used for lighting pipes, cigars, or fires, in the open air, and the strongest wind will not blow them out? E. B. S.

Ascent of Rockets.—The cause of the ascent of rockets, is the expansive force of the flame, which, not escaping *downwards* through the choke with the same rapidity as generated, exerts its remaining pressure in a contrary direction, and hurries the rocket *upwards*. For the same reason squibs fly back, guns recoil, &c. The experiment may be varied in the following manner:—Suspend a vial from the ceiling, in a horizontal position, by means of two strings; put into the vial a few pieces of granulated zinc, or iron turnings; pour upon them a little sulphuric acid, and about five times as much water, and cork the vial tightly. As soon as the hydrogen acquires sufficient power, the cork will be driven out in one direction, and the vial in the opposite. W. W.

ANSWERS TO QUERIES.

To prepare Chlorate of Potassa.—Procure a wide-mouthed bottle, or jar, as A, with a bung fitted to it, in which must be bored two holes, to admit the two tubes, B and C. Then introduce into the jar a solution of carbonate of potassa, in the proportion of one part of the carbonate to one of water. Introduce the bung; then attach to the tube, B, a bladder of chlorine gas, as D, and



press it so as to pass the chlorine slowly through the solution contained in the jar, keeping it at the lowest convenient temperature. The gas is absorbed, and the liquid effervesces, chiefly from the escape of carbonic acid gas, which passes off through the short tube, C. When the effervescence has ceased, the liquor may be put aside, in a cool dark place, for about twenty four hours, when it will be found to have deposited a considerable quantity of the crystallized chlorate, which may be taken out, drained, and purified by solution in hot water, which, during cooling, again deposits the salt in white crystalline scales. J. Mitchell.

Cure for Chapped Hands.—Melt four ounces of mutton kidney suet; then strain it through linen into another vessel, large enough to contain the whole; add to it one ounce of the best bees' wax, melted; and one gill of sperm oil. Stir the whole till a little cool, then add forty drops of the oil of lavender, and stir the mixture till quite stiff, to prevent the ingredients separating. The oil of lavender may be omitted. T. Roberts.

To make Printing Ink.—A composition of linseed oil, black rosin, hard soap, and lamp-black, mixed together, and well ground? H. T. B.

"E. L. L." may make the best and clearest varnish for prints, maps, &c., by dissolving two ounces of balsam of Canada in four ounces of spirits of turpentine. F. Connett.

TO CORRESPONDENTS.

S. C. *will oblige us by forwarding the papers he has offered.*

A Subscriber.—*Gravers for cutting steel are best prepared by hardening in clean water. They should not be tempered at all. Steel may be rendered nearly as soft as* iron *(not as* lead*), by exposing it to a long continued heat, and allowing it to cool gradually. There are different processes employed to effect this object, several of which have been described in the "Mechanic."*

Y. Z.—*It has been repeatedly stated, that hair is dyed by nitrate of silver; but some other substances, which we never had occasion to examine, are sometimes employed. Many of our correspondents are not aware, that the publication of the titles and prices of books would subject us to the advertisement duty. It is the less necessary that we should supply such information, as it may be obtained of any bookseller.*

NOTICE.

Our next Number will contain a very spirited

VIEW OF THE

PALACE OF THE QUEEN

AND PRINCE ALBERT;

As seen at the moment of their departure for Windsor on the day of the Royal Wedding.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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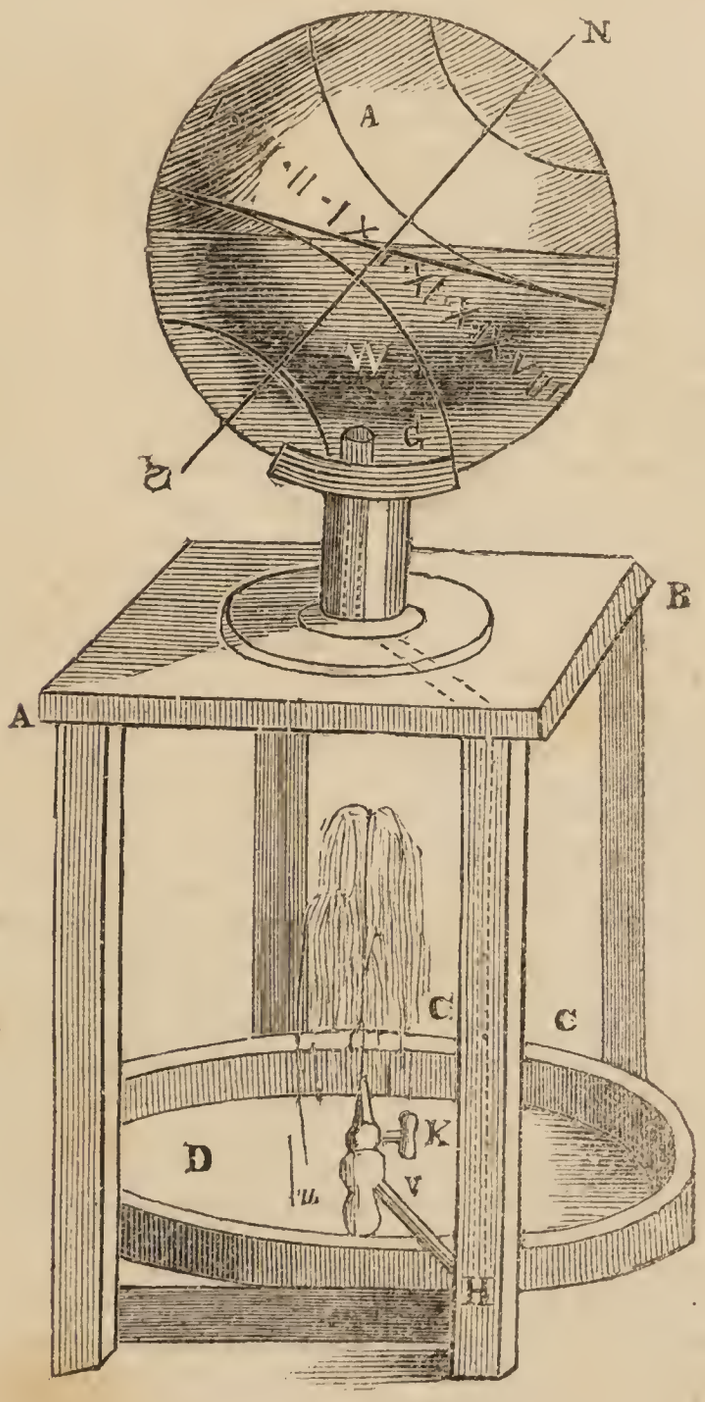
SELF-SUPPLYING FOUNTAIN AND SUN-DIAL.



Vol. V.—No. 36.] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

SELF-SUPPLYING FOUNTAIN AND SUN-DIAL.

(See Engraving, front page.)

This ingenious invention is recorded in the "Exper. Phil." of Desaguliers, and is thus described:—G N S is a hollow globe of thin copper, eighteen inches in diameter, supported by a small inverted bason, resting on a frame, A B C, with four legs, between which there is a large bason of two foot diameter. In the leg, C, there is a concealed pipe, proceeding from G, the bottom of the inside of the globe, along B V, and joining an upright pipe, *u* I, for making a jet at I. The short pipe, I *u*, going to the bottom of the bason, has a valve at *u*, under the horizontal part, B V, and another valve at V above it, and under the cock. At the north pole, N, there is a screw for opening a hole, through which the globe is supplied with water. When the globe is half filled, let the machine be set in a garden, and, as the sun heats the copper and rarifies the included air, the air will press upon the water, which, descending through the pipe, G C H V, will lift up the valve, V, and shut the valve, *u*, and, the cock being open, spout out at I, and continue to do so for a long time, if the sun shines, and the ajutage be small. At night, as the air condenses again by the cold, the outward air, pressing into ajutage, I, will shut the valve, V; but, by its pressure on the bason, D *u* H, push up the water which has been played in the daytime through the valve, *u*, and the pipe, *u* H G, into the globe, so as to fill it up again to the same height which it had at first, and the next sunshine will cause the fountain to play again, and so on continually till the water be exhausted by evaporation, and then it will be necessary to pour a fresh supply into the bason. The use of the cock, K, is to keep the fountain from playing till you think proper. A small jet will play six or eight hours. If the globe be set for the latitude of the place, and rectified before it be fixed, with the hour-lines or meridians drawn upon it, the hours marked, and the countries painted upon it, as in the common globe, it will be a good dial; the sun shining upon the same places on this globe, as it does upon the earth itself. The proper position of the globe, in a northern latitude, is the twelve o'clock pointing due south, and the axis parallel with the axis of the earth.

This construction of dial, though accurate in principle, will be found inconvenient in practice, owing to the indistinctness of the line which separates the light part from the shade; the improvement I would suggest is, to substitute a transparent glass globe for the copper one, with an axis passing through the centre, whose shadow on the part opposite to the sun will indicate the correct solar time. The obstacle to this construction is, that the zone on which the hours are painted (on a semi-transparent surface, by grinding or otherwise), can only extend to half the circumference, or from six in the morning to six in the evening; otherwise a portion of the semi-transparent zone would obstruct the passage of the rays at periods near the equinoxes. This inconvenience would not, however, be experienced, when the sun is considerably to the north of the equator, the time of the longest days. If the globe be filled with any limpid fluid, and the fountain omitted, a bright disk of light with a reduced, but distinct shadow of the axis passing across its centre, will be visible on the zone, at all seasons, when the sun is shining. A tube must be attached to the lower part of the globe, communicating with a reservoir of the fluid, in order to allow for the excess of expansion in the fluid, above that of the glass; if this be neglected, the globe would burst at an increased temperature, or air bubbles would enter at a lower temperature.

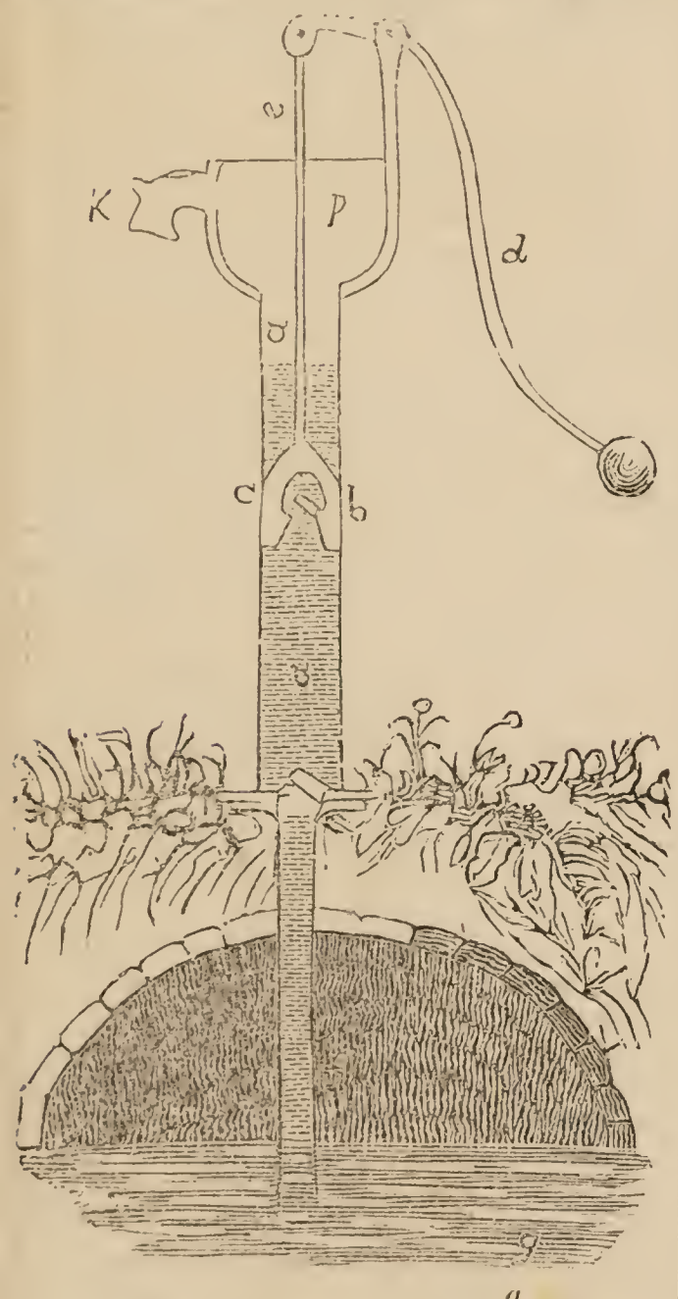
In a future paper, I will show how a *moon-dial* may be constructed, to show the time at night, notwithstanding the faintness of the light, and the complication of the motions of that planet.

Q. E. D.

HISTORY AND APPLICATION OF THE PUMP.

It is generally believed, that before the great Archimedes' time, the only apparatus used for raising or drawing water from wells, &c., was simply a bucket with a rope attached, which was either drawn up by the hands or attached to a windlass, similar to those now used in country places; for we have no account of any more complicated machinery being used for that purpose, until the introduction of the Archimedian screw (about 200 years before Christ), by that celebrated philosopher, whose name it bears. It was used at that time for draining the land in Egypt, which was occasionally so inundated by the Nile, as to be unfit for agricultural purposes; but even that was deficient in many instances; for it being so exceedingly cumbrous, if used to any extent, and so liable to become choked by dirt and weeds, it could not be used for raising water to any great height. This circum-

stance led to the introduction of the pump, which, according to Vitruvius, was invented about 135 years before Christ by Ctesebes, a celebrated mathematician of Alexandria; but little respecting its particular construction is handed down to us. It is, however, generally supposed to have been on what is now technically termed the lift-and-force principle, which will be hereafter described. This form of application does not seem to have been so commonly used even in earlier times, as the more simple construction, called the lift or suction-pump, of which the following is a description:—*a a* is a hollow cylinder,



called the barrel, having an air-tight piston, *b*, with a valve, *c*, opening upwards, working within it by means of the lever and rod, *d e*; *f* is the feeding-pipe, descending into the well or cistern, *g*, through which the water passes for the supply of the pump. It will be readily seen, that, upon the elevation of the lever, the piston, *b*, is depressed, by which action it forces out a portion of the air contained in the barrel through the valve, *c*; the water being driven up the feed-pipe by the force of the external atmospheric pressure, in proportion to the air discharged, until it reaches the body of the pump, when, upon the descent of the piston, it forces its way through the valve, *c*, which having once passed, it cannot return, in consequence of its opening upwards, and being both air and water-tight; it is, therefore, carried up to the cistern, *p*, where it is discharged at the spout, *k*.

Before entering into any farther description of the various pumps now in use, it may be as well to introduce a few remarks upon that subject which so long remained a mystery to the philosophers of old, and which has so material a part to perform in the action of the pump, viz., atmospheric pressure. It must be understood, that, when Ctesebes invented the pump, he was totally ignorant of the laws which regulate its action. Many of the philosophers of those days attributed the cause of the water rising in the pump, to the extraordinary power of suction which the piston possessed; hence arose the name of "suction-pump," while the philosophers of a later date attributed it to the abhorrence of nature for a vacuum; and thus the matter rested until near the commencement of the seventeenth century, when it so happened that a pump had been erected at Florence, and the distance through which the water had to be raised in that pump exceeded the maximum height, viz, 32 feet; the persons engaged in the undertaking were, consequently, surprised to find, that the water did not reach the top as usual. This circumstance attracted the attention of the illustrious Galileo, who resided in that city. The philosopher, finding that the water would not rise to its top as usual, set himself immediately to endeavour to account for the unexpected phenomenon, and, after carefully examining the case, came only to the conclusion, that nature certainly abhorred a vacuum, *but only for the first two-and-thirty feet.* It was his pupil Torricelli who first demonstrated the true cause of the phenomenon; he remarked the water rising, as it does, only to a certain height, must, in fact, be not drawn, but pushed into the barrel of the pump, and it can only be so pushed by the pressure of the atmosphere on the exposed portion of it. The thirty-two feet of water in the body of the pump are merely a counterbalance to a column of air of equal basis reaching to the top of the atmosphere. It will be seen from the above facts, that the lift-pump of ordinary construction can only be

used where the distance through which the water has to be raised, does not exceed thirty-two feet. The lift-and-force pump, therefore, possesses many advantages over this, which I will make the subject of another paper.

EPICTETUS.

LONDON JOURNEYMEN'S TRADES' HALL.

To the Editor of the Mechanic and Chemist.

SIR,—I am directed by the Committee to acknowledge your kindness in giving publicity to the proceedings of the public meeting, called in favour of the above undertaking on the 9th of March; and while they dissent from the remarks you have appended to the same, they respectfully beg your acceptance of their thanks for the candid manner in which you have expressed your opinions on the subject, which they, however, hope will be changed by a perusal of the laws which I have the pleasure of sending you.

I am, Sir,
Your obedient servant,
WM. FARREN, Jun.,
Secretary, *pro. tem.*

London Trades' Hall Office, Suffolk Coffee House, 16, Old Bailey, March 25, 1840.

To the Editor of the Mechanic and Chemist.

LONDON TRADES' HALL.

Sir,—Your candid remarks at the close of a notice of some proceedings at a public meeting in favour of this undertaking on the 9th instant, are evidently written in ignorance of the real *constitution* on which it is based, and I am, therefore, anxious to disabuse your mind, if possible, of sundry prejudices which you seem at present to possess, to its general discredit. I address you, not as the official organ of the Company now forming, but merely as an individual, deeply interested in its success, who has worked hard in its behalf from the first moment of its existence, and borne the most conspicuous part in its projection.

You place, by comparison, the London Trades' Hall *indirectly* in juxtaposition with the Geneva Society, in which "no individual" has "the power of controlling the affairs." I can assure you, that, in drawing up the laws which govern the shareholders, I have been deeply anxious to vest the *sole* management of the project in the hands of the *working men*, and I do venture to think, that I have effectually secured that great point, and barricaded the *transfer of shares* so closely, that no speculator can enter among the shareholders; nor can the shares ever get into the market to become *jobs*. Allow me to call your notice particularly in this place to the 2nd, 21th, 25th, 28th, 44th, 45th, and 60th laws. The working men must ever control the Trades' Hall, so long as two-thirds of them hold shares, and are qualified to vote, and act on the Council; and the fact of a great majority being operatives among the shareholders, must secure, from time to time, a council of working men, because the rich man, however greatly desirous to benefit the institution by his 100 or 1000 shares, can do no more harm with his *one vote*, than the unwashed labourer, who claims his solitary share. Equality reigns among the shareholders of this undertaking, and the laws will convince you, I trust, that no mercenary man can make *a property* in the project. The ordeal of passing the approbation of thirty working men before registration, must, I presume, have a tendency to destroy *jobbing* in the shares, and keep, therefore, the Trades' Hall perfectly free from the taint and suspicion of "*jobs* of this kind."

I cordially echo your opinion, "that it should be the *common property* of the members;" such it is intended to be; and, if the laws are not sufficiently comprehensive on that point, any friendly suggestions that would render them more explicit, will be hailed with gratitude by the Committee.

The conciliation of the "higher classes" is to me (as an individual) of no moment; I am anxious only to promote that union among my fellow-operatives, that shall carry with it in its development a forcible demonstration of their moral power; they have been too long degraded, carrying about the *Cain mark* of oppression and injustice, and fatally snared into intemperance, that they may be robbed of their birth-right by men who, because they compose "the higher classes," have no fellow-feeling with them, and dread the possession of a power which would destroy much of that insolent array of splendour and misery, profusion and want, idleness and toil, which disgrace the land of our birth. I would myself choose to see the working men release themselves without the foreign aid which some desire. I respect the higher classes, so long and so much as they fulfil the end of their creation; beyond that they cannot be, to a right thinking mind, aught but objects of contempt. There are exceptions, and I am glad to make and to know them individually; and, after all, what is the sum and substance of their conciliation to do? To admit them to the government of a hall

which is based on a demonstration of the *bundle of sticks*, because *labour* is too ignorant to manage its own dearest interests. Out upon the sophistry which would cloak all aristocratical intervention in an affair so important. The working man cannot be taught more than he knows at present of the misery of his condition; and, if he is wise enough to avoid the political Ahithophels of the day, he may build a Trades' Hall, use it as his castle, and leave it to his family as a heir-loom of industry.

I beg to apologize for this intrusion of honest opinions, and shall learn with delight, that an insight into the laws of our Company has produced any modification of your sentiments towards it.

I am, Sir,
Your obedient servant,
WM. FARREN, Sec.

Trades' Hall Office, 16, Old Bailey,
16th March, 1840.

We are much gratified with the courteous tone and firmness of purpose displayed in the foregoing communications; and we cordially respond in the same kindly spirit, not to maintain, through thick and thin, the opinions we before expressed, merely because we did express them, but to set forth to our readers the important facts which were not communicated to us at the time we wrote our former remarks. We perfectly agree with the worthy secretary on one material point, viz., that the operative members of the Institution should be effectually secured from the dictation, or influential interference of a class whose interests, if not opposed to those of the working men, are, at all events, totally distinct from them. This object, we are now informed, is effected by protecting clauses introduced into the laws for the constitution and government of the Trades' Hall. We transcribe the following, which are sufficient to show in what spirit these laws have been framed :—

"1. That, in order to promote the moral and social improvement of the working class, and to secure the erection of a Trades' Hall in some central part of London, where the meetings of trades may be better and more economically accommodated than at public houses, a capital of 15,000*l.* be forthwith raised by 15,000 shares of the value of 1*l.* each.

2. That, as a guarantee to the working class for the permanent security and acknowledgment of its interest in such Trades' Hall, and to give it a preponderating influence in its government from time to time, two-thirds of the whole number of shares shall be constantly in the possession of trades, &c., and individual operatives qualified to vote as hereinafter defined.

24. That all transfers of shares by trades, &c., or individuals, shall be effected by the Council for the time being, and shall be duly registered on payment of a fee of one shilling and sixpence; provided that the buyer of the shares so transferred, is in every case accepted by a majority of the Council; in which case he shall be furnished with a certificate of such registration, and a copy of these laws.

25. That the names of all persons proposing to accept shares by transfer, shall be submitted by the seller to the Council (in writing), for approval; and, in the event of any rejection by that body at any of its meetings, it shall be eligible for not less than one hundred shareholders to demand, by a written requisition, addressed to the Trades' Hall secretary, a ballot of the whole Council on the question at issue; and such ballot shall take place within seven days after the presentation of such requisition.

28. That, on the occasion of each and every ballot, every shareholder shall be entitled to one vote and no more, without reference to the number of shares which may be registered to him individually.

44. The Council shall consist of three members for every 1000 shares, making, in the whole, forty-five, who shall be elected at each annual meeting of the shareholders by ballot, two-thirds of whom shall belong to the working class, provided that no person shall be eligible to a seat in the Council, unless being, at the time of such election, a registered shareholder; and that the names of the Council, after every such election, be exhibited constantly in some public part of the Trades' Hall.

45. That every shareholder duly registered, shall be eligible to be elected on the Council, without reference to the number of shares held by him.

60. That in the event of any buyer of shares being, in the opinion of such registration committee, an improper party to be admitted into the Trades' Hall Proprietary; they shall report the same to the Council at its next meeting, and such Council shall decide on the admission or rejection of every such buyer, subject to the conditions of appeal by ballot against every such decision as are defined in these laws."

This appears to us quite satisfactory, and a sufficient security for the independence of the operative members.

With regard to the Society assuming a

character more or less political, that must, to some extent, depend upon the members themselves, rather than upon the laws of the institution. We think it would be expedient and beneficial to the working men, to confine their deliberations to subjects and laws which directly concern them as artizans, and not enter the labyrinth of general politics;—this, however, we merely give as an opinion, not as a ground of opposition, should they choose a different course. Our conviction of the expediency of seeking to command consideration and respect, rather than creating alarm, is unshaken; but when we speak of "conciliating the higher classes," we intend no more than that a good understanding should be cultivated on both parts; and nothing is farther from our wish, than to see an aristocracy of any denomination meddling with the government of the Trades' Hall—on the contrary, we advised that the administration of the Society's affairs should be vested solely in *bonâ fide* operatives.

The legitimate object of an establishment of this nature is, to impart respectability, and afford accommodation and protection to the meetings of the various trades, and to instruct and moralize, while it defends and advances the more immediate and material interests of the classes for whose benefit it is instituted. We do not doubt that such are the views of the Committee; but we think the success of the undertaking would be promoted by an address to the working classes, explaining the proposed administration and interior regulations of the Society. It is desirable that the privileges and benefits offered to the shareholders should be clearly defined, and the conditions upon which non-proprietors might be admitted, and other such details fully explained; it would also prevent many future dissentions and bickerings, if it were at once declared to what extent the Society is intended to act as a political party, and what guarantee will be offered, that political discussions shall not degenerate into unlawful and seditious meetings. We do not wish to exclude politics, but we most earnestly recommend that such subjects should be confined within what we conceive to be their proper limits. Let us suppose, for instance, that the introduction of some foreign article should, by its cheapness, or by any peculiarity, supercede the British manufactured article, and throw a number of workmen out of employment; the master manufacturer and the merchant, with their capital, can easily find other sources of profit; but the artizan, who is, perhaps, acquainted with no other trade, is exposed to utter ruin, and has no other hope but the removal of the cause of his distress. In such cases, the workmen should assemble, set forth their grievances, memorialize the Minister, and petition Parliament; and if the persons who are sent to Parliament to advocate the cause and defend the rights of the people, so far betray their trust as to grant no redress, more influential persons must be applied to, and the "honourable House" must be again petitioned and "*ever prayed*" to, till they do grant it. This, and *any question which especially regards the working class*, we consider fit subjects for their deliberations, and for the exertion of their utmost energies; but if they suffer themselves to be decoyed into the stormy regions of party politics, they will find their best interests merged in the turmoil of contending factions, and discover, when it is too late, that they have unknowingly been made the tools of intriguing ambition, and they will be deserted by those who pretended to be not only their best, but their only friends.

We trust that these remarks, whether they be or be not in accordance with the opinions and intentions of the Committee, will be received as they are intended—not as the arguments of an adversary, but as the suggestions of a sincere friend, dictated by an anxious solicitude for the welfare of the working classes, not only of this city, but of the whole country.

To the Editor of the Mechanic and Chemist.

Sir,—Noticing your important critique on the proposal to erect a "London Journeymen's Trades' Hall," in my mind unexceptionable, not only from the example you refer to in Geneva, but from your concluding remarks, I feel myself really indulging the hope of forwarding your honourable designs.

You reckon on donations, though not exclusively; my present is chiefly to intimate, while I despair not of others. A hard-working man has left in my hands 10*l.* of his savings, as it appears, from pure fulness of heart, finding himself prepared to spare it towards the cultivation of the plant under your direction, or where there can be found one so well qualified, as soon as it takes root.

Aquemolus.

39, Brunswick Street, Blackwall.

We have taken the liberty of omitting that portion of our worthy correspondent's letter which relates to his political opinions, not because we condemn them, but

because such subjects are entirely foreign o the objects of this work; and we al- vays avoid them, unless the interests of hose whose cause we advocate, require uch occasional allusions as we were ompelled to admit in our foregoing re- narks. We cannot help admiring, as very one of our readers must do, the dis- nterested zeal which has induced our riend to sacrifice so considerable a sum or the benefit of his fellow-workmen. We eel a gratification in having inspired that onfidence which it will ever be our pride o deserve; but we cannot recommend a neasure which under present circum- tances would be calculated to create lisunion, and let these words never be orgotten—*union can only be preserved by nutual concession.*

Let us wait for farther information con- erning the projected Trades' Hall, which ve do not despair of seeing rendered un- xceptionable to all parties; in the mean ime, and upon all occasions, let good ellowship be cultivated and prized above ll other things: let every man support is fair portion of the burden in all under- akings for public benefit, and let zeal be empered with caution and discretion. The great diplomatist Tallyrand was ever zealous; he once addressed the ollowing words to the persons employed nder him in an important department:— " Gentlemen, I only require of you the aithful discharge of your several duties; desire that you should not be zealous— entlemen, I hate zeal."

MPROVEMENTS IN THE ARGAND LAMP.

BY SIR J. F. HERSCHEL.

The following simple, easy, and unex- pensive mode of greatly increasing the uantity of light yielded by a common Argand burner, has been used by me for ome years, and is adapted to the lamp by which I write, to my greatly-increased omfort. It consists in merely elevating he glass chimney so much above the sual level at which it stands in the urners in ordinary use, that its *lower* dge shall clear the *upper* edge of the cir- ular wick by a space equal to about the ourth part of the exterior diameter of the vick itself. This may be done to any amp of the kind, at a cost of about six- pence, by merely adapting to the frame which supports the chimney four pretty tiff steel wires, but in such a manner as o form four long upright hooks, in which he lower end of the chimney rests; or, till better, if the lamp be so originally onstructed as to sustain the chimney at the required elevation without much addi- tion, by thin laminæ of brass or iron, hav- ing their planes directed to the axis of the wick. The proper elevation is best determined by trial; and, as the limits within which it is confined are very nar- row, it would be best secured by a screw motion applied to the socket on which the laminæ above mentioned are fixed, by which they and the chimney may be ele- vated or depressed at pleasure, without at the same time raising or lowering the wick. Approximately it may be done in an instant, and the experiment is not a little striking and instructive. Take a common Argand lamp, and alternately raise and depress the chimney vertically from the level where it usually rests, to about as far above the wick, with a mo- derately quick but steady motion. It will be immediately perceived that a vast dif- ference in the amount of light subsists in the different positions of the chimney, but that a very marked and sudden *maximum* occurs at or near the elevation designated in the commencement; so marked, indeed, as almost to have the effect of a flash if the motion be quick, or a sudden blaze as if the wick-screw had been raised a turn. The flame contracts somewhat in diame- ter, lengthens, ceases to give off smoke, and attains a dazzling intensity. With this great increase of light, there is cer- tainly not a corresponding increased con- sumption of oil: at least the servant who trims my lamp reports, that a lamp so fitted consumes very little, if any more oil than one exactly similar on the com- mon plan.—*Phil. Mag.*

SUCCESS OF THE PENNY POST- AGE.

The practical results of the penny-postage experiment, so far as they have been as- certained and published, are very satis- factory. First as regards revenue. It will be remembered that Mr. Herries, who professed to have some acquaintance with the business of the department, esti- mated the loss to arise from the change in the rates of postage at from 1,200,000*l.* to 1,400,000*l.* Now it appears from a Par- liamentary paper delivered this week, that the amount of postage collected in the London district was,

From Jan. 10th to Feb. 13th, inclusive	£60,060	14	8
The amount collected dur- ing the same period of 1840, being that in which the penny postage first came into operation .	40,527	8	7
	19,533	6	1

The decrease of receipts has been less than one-third. Now if the same proportion holds good throughout the country, the loss will be only about half of Mr. Herries' calculation.

The gross revenue of the Post-office may be put down at, in round numbers, ...	£2,000,000
One-third (sinking the fractions)	666,666

It must be remembered that the plan has not had a fair trial. In the first place, it is as yet imperfectly developed. The stamped covers are not ready, and the inconvenience of sending a penny with every letter continues. The stagnation of trade has been remarkable; and the holiday on the Queen's marriage diminished the number of letters in the London district for the week in which it occurred by no fewer than 70,000.

But we regard the revenue question as subordinate to other considerations. Penny postage was not desired for the purpose of swelling the Treasury coffers, but for increasing the means of intercommunication. And it is indeed encouraging and delightful to mark how extensively this benefit has arisen from the reduction of rates.

The number of letters for the period between Jan. 10th and Feb. 13th, 1839, was	930,215
For the same period in 1840, under the penny rate	2,286,385

We have made some inquiries as to the sources of this enormous increase, and are glad to learn that, to a considerable extent, it is attributable to the correspondence of the humbler classes, in their various capacities.

So far then the great experiment works well, and bids fair to confound the croakers.—*Spectator.*

CHEMICAL AND PHILOSOPHICAL SOCIETY,

236, HIGH STREET, SHOREDITCH.

To the Editor of the Mechanic and Chemist.

SIR,—After the letter of Mr. R. S. Jeffs was sent to your paper for insertion last week, the provisional committee of the above-named Society determined to postpone the opening for a short period. It was, therefore, not done on Wednesday last, as stated in No. 84 of your Journal, but is expected to take place on or about the 15th of next month, of which you will be kind enough to allow us to give notice. In the mean time, anyone willing to join the above Society, will please to forward his address (post paid), either to Mr. R. S. Jeffs, 81, Shoreditch, or to me.

I remain yours, &c.,

H. WIGLESWORTH, Sec.

65, Tooley Street.

P.S. The subscription is fixed at 8*s.* per annum.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 8, W. Rider, Esq., on Engraving. Friday, April 10, G. F. Richardson, Esq., of the British Museum, on Corals, and the Marbles they compose. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, April 9, T. Downing, Esq., on Photogenic Drawing, and the Daguerreotype, with Illustrations. At eight o'clock.

QUERIES.

How India-rubber can be dissolved, so as to make it into any form you may wish?

T. H. B.

The process of embossing on leather; how are the lines and figures stamped on, and the gold leaf applied? Also, how are the colours prepared and applied to the edges of books?

H. B. N.

How ginger-beer fountains act? And a receipt for making ginger beer for the fountain?

T. M.

TO CORRESPONDENTS.

W. N. *is mistaken; and* L. L. *has given the true solution of the problem. For by the question,* L *l*, *l l'*, *l' l''*, *&c., are equal spaces, and* P *p*, *p p'*, *p' p''*, *&c., are also equal spaces; join p l*, *p' l'*, *&c., and they will all be parallel to* P L, *since they all point to the north; and* P C *is a straight line, because no curve will fulfil the above conditions.*

S. Wilson.—*Quicksilver may be separated from silver, by submitting the amalgam to a red heat. If it be required to collect the mercury, the crucible must be covered, and a tube inserted to convey the vapour into any convenient vessel as a receiver.*

Our Artist being unable to complete the Engraving of the

PALACE OF THE QUEEN AND PRINCE ALBERT,

which we promised last week, we are compelled to defer its appearance till next week.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand: and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 86 & 87, NEW SERIES. } SATURDAY, APRIL 11, 1840. (PRICE TWOPENCE.) { Nos. 207 & 208, OLD SERIES.

BUCKINGHAM PALACE.

Vol. V.—Nos. 37 & 38] City Press, 1, Long Lane, Aldersgate Street : D. A. Boudney.

BUCKINGHAM PALACE.

(See Engraving, front page.)

The "interesting event" which has elevated the Prince Albert to the exalted station he now occupies, has induced the proprietors of numerous periodical publications, to present their readers with portraits of her Majesty and her Royal Consort; our reasons for not doing so, will, we trust, be considered by our readers as amply sufficient to justify us in pursuing a different course. It is not only because the representation of a work of art is best adapted to the character of this publication, but because we trust our readers will have frequent opportunities of contemplating her Majesty's effigy, not only in silver, but in those eminently useful discs of gold, which bear the portrait, as well as the title and the power of the *sovereign*. We have also a motive of economy; for it is not unlikely that, at some future period, we shall be able to produce a single portrait, which will combine the likeness of both those illustrious personages.

Buckingham palace, after many years' delay, and the expenditure of vast sums of money, was completed, and became a royal residence, by her present Majesty's taking possession of it shortly after her accession to the throne, viz., July 13, 1837. Its situation is unfavourable to the display of any effect of grandeur when viewed from a distance; and the structure of the building is not calculated to overcome, in any degree, the disadvantage of its position. A stranger would never suspect that it was the palace of the Queen of England; it appears, from a distance, much more like a palace of united parishes, than of united kingdoms. The apartments are by no means spacious, and they are too limited in number. We have, however, taken a view which shows it to the best possible advantage, and upon the joyful occasion of her Majesty's marriage. The dimensions are as follow:—Width of wings, 150 feet; depth of wings, 110 feet; width of ditto in front, 49 feet; extent of front, including wings, 238 feet; extreme length, including the ground-floor addition to the wings, 432 feet. The height of the Doric order and its socle, is 26 feet; and from its cornice to that of the Corinthian order, 40 feet; making the entire height 66 feet, exclusive of pediments, &c.

The marble arch and bronze gates have incurred the same universal censure as the edifice itself; we can only say that it is an inelegant and utterly useless mass of marble and metal.

PENNY-POSTAGE STAMPS.

The enemies of this great and popular measure are beat at every point; their arguments are exhausted, and their rage has subsided into sullen desponding melancholy. There may be, and we believe there are, some whose incorrigible malignity still strives to deprive the people of the vast benefits which the cheap postage has conferred upon them; to these we shall at present only say, with the points of our pens we have gained it, and with the points of our pens we will defend it.

The arrangements for issuing the different kinds of stamps are now nearly completed; but it is expected that they will for the present only circulate in the London district, formerly the twopenny post. The following is from the "London and Westminster Review":—

"Each kind of stamp has, in truth, its own peculiar advantages. The adhesive stamp has portability to recommend it; twenty shillings' worth of postage will not weigh half-an-ounce, and will occupy scarcely a perceptible space in a pocket-book. Its lightness is such, that it hardly adds to the weight of a letter. It may be attached to letter paper of any kind, either before or after the letter is written. It saves trouble: being purchasable at the Post Office, it may be attached to a letter at the very time when the letter is posted, and a single journey to the Post Office to post the letter must at all events be made. One real objection to the exclusive use of stamped covers is, that the Post Office stamp, certifying the date and place of posting the letter, which are sometimes wanted in evidence, would upon that plan be affixed only to the envelop, and not to the letter it encloses. This objection does not apply to letters franked by the adhesive stamp. It is also the best suited for parcels or letters exceeding the lowest weight; as, on ascertaining at the Post Office the proper amount of postage, additional stamps may be at once affixed. These stamps will, moreover, be a very convenient and novel paper currency for sums of small amount.* Correspondents will pay small debts of pence through the medium of these penny stamps. You wish to order a twopenny pamphlet or a fivepenny newspaper; by transmitting in an envelop the required number of stamps, you effect the payment,

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* Indeed for any sums whatever under a pound sterling. A sheet of the adhesive stamps, *minus* two cut off, will be good paper for 18*s*. 10*d*.; a sheet, *minus* five, will be good for 18*s*. 7*d*., and so on.

which, for such sums, there are no ready means of doing at present. The cost of manufacturing these stamps will be sufficiently low to enable Government to sell them, in all parts of the country, for the penny only; whereas the price of a single cover, including the penny for postage, cannot well be less than 1¼d.

The greatest recommendation of the stamped cover is, the facility it affords to the poor man of obtaining at every post-office a cheaper piece of writing-paper than he has ever before been able to buy. For a farthing he will buy paper sufficient for most of his letters. This accommodation will exercise to some extent a beneficial influence on the habit of letter-writing, and on the amount of postage, particularly in rural districts, where letter paper is now sold of a bad quality and high price at the huckster's shop, which supplies the miscellaneous wants of a whole district. Mr. J. W. Parker, the extensive publisher, pointed out to the Committee the manner in which the stamped covers will be used as trade circulars. A tradesman would print upon the inside of a cover a list of his goods for sale, and on the outside his own address, whereby he would secure to himself the exclusive use of it. He would then enclose these circulars to his connexions, who would mark against each article the quantity required, and remit the circular by post to the sender. * * *

It has always been contended, that beauty of design and workmanship is one of the best securities against forgery. This is at last felt even by the Directors of the Bank of England, and a new Bank-note is in preparation from a design by Sir Richard Westmacott, to be engraved by J. H. Robinson, and is expected to contain every beauty which art is capable of giving to it. What will be in this respect the character of the postage stamps, may be inferred from the artists who are employed in the production of them. We need only mention the names of W. Mulready, W. Wyon, J. Thompson, C. Heath. The idea of calling in the powers of art as auxiliary to the philanthropic agency of the penny post, is a happy one. Such an opportunity of spreading models of beauty over the whole face of the country (we might almost say the world), and among all classes of the people, has never occurred before in the history of mankind. Never before has artist had so glorious a host of spectators for his efforts, and the distribution of hundreds of millions of a beautiful object, cannot be without its effect on the education of the public taste. The Chancellor of the Exchequer could not have selected four artists more suitable for his purpose. The designs on the die in the hands of Mr. Wyon, and on the plate in the hands of Mr. Charles Heath, have been stated to be the head of the Queen. Mr. Wyon's die is, we presume, intended for the letter paper, and Mr. Heath's plate for the adhesive stamp. A forgery of the work of either of these distinguished artists, to deceive (as it must do to be effectual) an experienced eye, would be a work we should very well like to behold. The mechanical execution, both in stamping and printing, will, it is fair to suppose, do justice to the performances of these artists; and such processes have of course been adopted, as to insure perfect identity in the numerous dies and plates which will be necessarily wanted. Of Mr. Mulready's design, which is confided to Mr. John Thompson, we can speak in the highest terms. In less than half the usual space for the face of a letter, the artist has placed groups of upwards of forty figures. In the centre is Britannia, in the act of despatching four winged messengers. The figures on each side of her, are groups emblematical of British commerce, and communication with all parts of the world. On the right are East Indians on elephants, directing the embarkation of merchandise; next Arabs, with camels laden; next Chinese; on the left, American Indians concluding a treaty, and negroes packing casks of sugar. The whole design occupies rather more than an inch in width along the face of an ordinary envelop. In what may be called the foreground on the one side, a young man is reading a letter to his mother, whose clasped hands express her emotion at its contents; on the other side, is a group of three figures, each one eagerly pressing around to read, or, at least, catch a sight of the welcome letter. The whole conception forcibly tells its story, and suggests emotions of gratitude at the universal blessings that flow from unfettering correspondence, which is but speech by means of written characters. As a work of art, in respect of composition and characteristic portraiture, it is eminently successful. The national peculiarities of attitude and costume, though expressed by outline only, are so well preserved, that each group may be instantly recognised. The whole design is like a pen-and-ink sketch by a distinguished artist, as far removed as possible from the common-place designs usually employed in analogous cases. And, considering the small space, the mode of

printing to be employed, and other circumstances necessarily fettering the artist's powers, we think that artists and the public will agree with us, that Mr. Mulready has produced the very best work of art consistent with the conditions within which, by the nature of the case, he was confined."

LIFE ASSURANCE.

NO. III.

RATES OF PREMIUM.

WHAT has been already advanced on the subject of life assurance, it is hoped the reader will re-peruse, previous to the investigation of this chapter, as the subject last treated deserves the most careful observation. Let us, therefore, notice farther, for a moment, that the plan there stated, as being universally adopted by the life offices, is the only method for assuring a just and equitable proportion among those who may become assurers; for, as was stated, if sufficient was taken from each person wishing to assure his life, to cover the *expected* claim at an *expected* period, without allowing a portion of the interest accruing to form a part of such payment or annual premium; then the office following such a course, would realize immense gain,* and the assurer's real claim would even exceed the sum adduced by a simple statement in proportion: for example:—12 : 12*l.* 2*s.* 7*d.* :: 500*l.* : 670*l.* 16*s.* 8*d.*; or, more than 170*l.* 16*s.* 8*d.*, beyond the sum stipulated to be paid.

It is precisely upon the principles which the societies choose for their guidance in respect to the duration or expected term of a person's life, that they are enabled to assure a life for one year only, at a much less premium than has been named; for example, at the age of thirty, a person would have, generally, 16*l.* 15*s.* to pay down, which would assure his family 1000*l.*, should he die before the expiration of the year. Now the remarks before made will hold equally good in this case; for suppose 10,000 persons were to make this assurance at the same age, by the Northampton table, 171 would die in the course of the year, and their claim would be 171,000*l.*; therefore the premium each had paid the society, would require to be placed at interest; for observe, all premiums should be paid at the commencement of the year, and 2*l.* 1*s.* 9½*d.* per cent. interest added to such premium, would then cover their claim; while the surplus interest which every society would be able to make beyond 2*l.* 1*s.* 9½*d.* per cent. would form a part of the accumulating fund of the society. We admit the success of any society would be greater as the numbers of the assurers increased, so far as respects the interest to be gained by the use of their premiums; but a greater advantage would occur upon the probability of fewer deaths happening, than stated in the present estimate; still, the probability which here exists in favour of the office, is counterbalanced by the fact, that not a thousand persons do in one year join a single life-assurance society, upon any of the plans which they offer to the public.

We think this truth may prove of service to many, inasmuch as hundreds are daily called away from their families and dearest connexions, without having made the slightest provision for such a calamity; and particularly do members of the various professions and mechanics feel this, since their means are the most precarious, however long their lives.

It may be stated, with some degree of confidence, that at every age a premium can be estimated for a society's use without material error; so that for each person a fixed rate shall appear. For the term average would be unjustly applied to this purpose, that is, to the equalisation of various ages to one price,* since we have such a multitude of evidence on the subject in this enlightened age. But there may be mistakes arising from ignorance, in framing a table of premiums upon any given expectancy of life. It is common with most offices to assume some table of mortality throughout, that is, for their

* The Equitable Society, in 1771, charged for assuring a person aged twenty, 100*l.* at death, the sum of 3*l.* 9*s.* 4*d.* per annum, which was, in 1779, reduced to 2*l.* 12*s.* 10*d.*; and subsequently, when they found their fund rapidly on the increase, it was reduced to 2*l* 3*s* 7*d.* The following remark of Mr. Morgan, the eminent actuary of that society, may support this statement:—"For the first twenty years the society possessed such an excess of income, that, being suffered to accumulate without interruption, it contributed, in a great measure, to form the basis of its future opulence."

* The Amicable Society, which, in the year 1760, was the only one existing, was originally founded rather on principles of mutual benevolence, than of mutual assurance, as now understood. A certain number of persons (the only restriction being, that their ages should be between twelve and forty-five), each paying the same sum yearly; the whole fund of each year, or the greater part, was divided among the representatives of those who died within the year.—*De Morgan on Probability.*

younger, middling, and older ages. They likewise adopt a fixed ratio of interest per cent., by which the premiums are reduced to the assurer in manner before stated, and this is likewise calculated upon the whole table; so that premiums estimated upon the Northampton tables of mortality, reckoning a high rate of interest (or discount, more properly) to reduce such premiums; and such as were calculated upon the Carlisle tables, with a low rate of discount, would resemble each other in the middle ages of life; but a disparity, or difference of premium, would appear at a more advanced age. Hence appears the fact, that the older ages are not so well known as those which precede, and of which there has undoubtedly been greater opportunities of judging. Under these circumstances, therefore, the advantages and disadvantages which spring from the actual experience of societies long established, and the tables of mortality, respectively, require to be placed in juxtaposition, to attain that degree of truth necessary for fixing a rate of premium for the older ages; or the ratio of discount should be somewhat increased.

Let it be thoroughly understood, that the world has now sufficient evidence before it, to compute any table a society might require without risk; and that a low rate of interest should be calculated upon is obvious, since the premiums would be higher, and a mistake on any point, not too important, might thus be compensated by the society dividing its gains among all the members; as is the case in the Equitable, the Mutual, and some others.

For the present, it cannot be denied, that much confidence (we would say credulity) is required to enable many of the societies which have sprung up within the last few years, to gain assurers; but the errors which exist in some, are caused, probably, by the mistakes to which we have alluded. An investigation of all their rates of premium is desirable, however, provided persons are not led, by their seeming bright promises, to follow *cheapness* in preference to *stability*. This last qualification is certainly the standard to which we would point; and, by way of conclusion, we give the tables of three offices, whose premiums are quite as low as can be prudently recommended, considering they divide all their profits; a subject which we must consider in our next chapter.

Age.	Metropolit	Mutual.	National Provident.
	£ s. d.	£ s. d.	£ s. d.
15	1 15 8	1 15 7	1 15 2
20	1 19 6	1 19 11	1 19 4
25	2 4 0	2 4 7	2 4 3
30	2 9 9	2 10 2	2 10 2
35	2 17 5	2 17 5	2 17 5
40	3 6 4	3 7 6	2 6 3
45	3 18 11	3 17 11	3 17 4
50	4 12 0	4 12 7	4 11 1
55	5 9 1	5 14 4	5 8 8
60	6 11 6	7 2 0	6 11 10

SIGMA.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 235.)

NORTHAMPTON is pleasantly situated on an eminence, at the foot of which is the river Nen. It contains four churches; All Saints', St. Sepulchre's, St. Giles's, and St. Peter's. The principal one, All Saints', is situated in a central part of the town, at the meeting of four spacious streets. It has a portico of eight Ionic columns, with a statue of King Charles II. on the balustrade, erected to perpetuate the gratitude of the town for the munificence of that monarch, who granted 1000 tons of timber, and seven years' chimney-money, towards repairing the church, which was completed in 1712. It contains a statue, by Chantrey, of the Hon. Spencer Perceval. St. Sepulchre's is an ancient struc-

ture, supposed to have been erected by the Knights Templars, and copied from an erection over the Holy Temple in Jerusalem. It is of a circular form, with a cupola in the centre, supported by eight Norman pillars. St. Giles's possesses no remarkable feature to interest either the antiquarian or the architect; but St. Peter's is a curious relic of ancient architecture. This town also contains a very spacious and handsome market-place, and several elegant public edifices; the streets are regular, and the houses built of stone, and mostly slated. A race-course was formed in 1778, and the races held there annually in the autumn, are well attended. The proximity of the Roade and Blisworth Stations, each about five miles distant, has reduced the time of a journey to London (66 miles) to little more than three hours. The river Nen unites with numerous canals, and forms communications by water to the German Ocean, London, Liverpool, and Bristol.

Northampton is considered the greatest manufactory of shoes in the world, and many thousands of men, women, and children, are thence supplied with profitable, and almost constant employment. This manufacture extends over a great portion of the county, not only in large towns, such as Wellingborough (that strong hold of true English hospitality), but in the remotest villages. There were formerly seven churches in Northampton, but three of them were destroyed by the great fire. There were also monastic establishments of Franciscans, Dominicans, Eremites, and Carmelites; these, too, are gone and forgotten, and their legends, their deeds, and their very names are lost in the mist of expiring tradition.

Weedon Station, a principal one, 69¾ miles from London, 42½ from Birmingham, is situated at a village called Weedon Bec, about five miles from Daventry. This village is also called Weedon-in-the-street, from its being situated on the Roman way, called Watling Street. The Grand Junction Canal passes close to Weedon churchyard, upon an embankment thirty feet high, reaching above the body of the church, and nearly on a level with the bells. One of the most extensive military depôts in the kingdom, is established at Weedon; regiments returning from unhealthy climates, are frequently sent to this place for the benefit of its remarkably pleasant situation and healthy climate.

From Weedon, the railway is continued first through a cutting of considerable depth, and afterwards upon an embankment, with a gradual rise, till it crosses the Grand Junction Canal on the Long Buckby Viaduct. From this point it proceeds in nearly a straight line to

Crick Station, an intermediate one, 75¼ miles from London, 37 from Birmingham. Passing over a viaduct at Crick Station, the railway proceeds through a deep cutting to Kilsby Tunnel, the longest upon the line, being one mile and 640 yards in length. Immense difficulties were opposed to the completion of this Herculean undertaking; the nature of the strata was extremely unfavourable to the execution of the work, and the great quantity of water which issued from numerous springs was a serious impediment, and required the constant assistance of powerful steam-engines to prevent its accumulation. The occurrence of a quicksand of considerable extent, was also a formidable obstacle; but every difficulty was triumphantly surmounted, though at an immense expense to the Company. About a mile beyond this tunnel, the line passing through a deep cutting, quits the county of Northampton, and enters Warwickshire, at Hill Moreton Viaduct, which passes over the turnpike road and Oxford Canal; it then proceeds upon the Hill Moreton embankment to

Rugby Station, a principal one, 83¼ miles from London, 29 from Birmingham.

Rugby is a market town in Warwickshire, 83 miles from London, 13 from Coventry, and 16 from Warwick. In Doomsday Book, the name of this place is written *Rocheberie*, which signifies a noble habitation on a rock, or quarry of stone. It possesses an excellent and richly endowed school, founded by Lawrence, Sheriff of London, grocer or haberdasher (terms which appear to have been nearly synonymous in the 16th century, both signifying a retailer of small wares), in the ninth year of the reign of Queen Elizabeth. It is curious to trace the gradual, but enormous increase in the value of the property bequeathed at that period. A portion of the property left for the support of the school, was eight acres of land, situated in Lamb's Conduit Fields, *near* London, and termed the Conduit Close. The value of this land was so small, that in 1576, the whole Lamb's Conduit property, consisting of 24 acres, was let for the annual rent of 50*l*., and a lease granted for 50 years; another lease was afterwards granted for a term of 43 years, at 60*l*.; and, up to 1780, the whole revenue of the institution amounted to only 116*l*. 17*s*. 6*d*.; but soon after the extended term of lease was granted, projects

of building were entertained, and the metropolis extending in that direction, it was computed that a ground-rent of 1600*l.* would accrue to the charity on the expiration of the lease. Since that period, the value has so rapidly increased, that, at the present time, the Lamb's Conduit estate yields no less than 5000*l.* per annum. In 1808, it was decided by the trustees, that an entire new edifice should be erected, and their intentions were speedily carried into effect. The present building is in the Elizabethian style, of vast dimensions, and well adapted to the objects for which it is intended.

ON THE SOURCE OF POWER IN THE VOLTAIC PILE.

At a recent meeting of the Royal Society, a very interesting paper was read, establishing an important fact in electro-chemistry, by M. Faraday, Esq.

The determination of the real source of electrical power in galvanic combinations, has become, in the present state of our knowledge of electricity, a question of considerable importance, and one which must have great influence on the future progress of that science. The various opinions which have been entertained by philosophers on this subject, may be classed generally under two heads; namely, those which assign as the origin of voltaic power, the simple contact of dissimilar substances, and more especially of different metals; and, secondly, those which ascribe this force to the exertion of chemical affinities. The first, or the theory of contact, was devised by Volta, the great discoverer of the voltaic pile; and adopted, since it was promulgated by him, by a host of subsequent philosophers, among the most celebrated of whom may be ranked Pfaff, Marianini, Fichner, Zamboni, Matteucci, Karsten, Bruchardat, and also Davy; all of them bright stars in the exalted galaxy of science. The theory of chemical action was first advanced by Fabroni, Wollaston, and Parret; and has been since farther developed by Oersted, Becquerel, De la Rive, Ritchie, Pouillet, Schonbein, and others. The author of the present paper, having examined this question by the evidence afforded by the results of definite electro-chemical action, soon acquired the conviction of the truth of the latter of these theories, and has expressed this opinion in his paper, published in the Philosophical Transactions for 1834. The author, after stating the fundamental doctrine laid down by Volta, proceeds to give an account of various modifications in the theory introduced by subsequent philosophers; and also of different variations in the views of those who, in the main, have adopted the chemical theory. Being desirous of collecting farther and more decisive evidences on this important subject, he engaged in the series of experimental researches which are detailed in the present memoir. It is assumed, he observes, by the advocates of the contact theory, that although the metals exert powerful electromotive forces at their points of mutual contact, yet, in every complete metallic circuit, whatever be the order or arrangement of the metals which compose it, these forces are so exactly balanced, as to prevent the existence of any current; but that, on the other hand, fluid conductors, or electrolytes, either exert no electromotive force at their place of contact with the metals, or, if they do exert such a power, the forces called into play in the complete circuit are not subject to the same law of compensation, as obtains with circuits wholly composed of metallic bodies. The author successfully combats this doctrine, by bringing forward a great number of instances where certain fluids, which have no chemical action on the metals with which they were associated in the circuit, are in themselves such good conductors of electricity, as to render evident any current which could have arisen from the contact of the metals, either with each other or with the fluid: the evidence of their possessing this conducting power being their capability of transmitting a feeble thermo-electric current from a pair of plates of antimony and bismuth. The following he found to be fluids possessing this property in a high degree; namely, a solution of sulphuret of potassium, yellow anhydrous nitrous acid, mixed with nearly an equal volume of water, very strong red nitric acid, and a mixture of one volume of strong acid with two volumes of water. By employing the solution of sulphuret of potassium as an electrolyte of good conducting power, but chemically inactive with reference to either iron or potassium; and, associating it with these metals in a circuit, formed by two test-glasses containing the solution, into one of which was immersed a plate of platina and a plate of iron, and in the other two plates of platina; and the circuit being completed by wires of the same metals respectively, joining the iron plate in the first glass with one of the platina plates in the second, while the other two platina plates were united by platina wires, interrupted at one part by a

short iron wire which joined their ends. It was found by the test of an interposed galvanometer, that, as no chemical action took place, so no electric current was produced; yet the apparatus, thus arranged, could transmit a very feeble thermo-electric current, excited by slightly raising the temperature of the wires at either of their points of contact. Hence the inference may be drawn, that the contact of iron and platinum is of itself productive of no electromotive force. On the other hand, the author shows, that the interposition in the circuit of the smallest quantity of an electrolyte, which acts chemically on either of the metals, the arrangement remaining in all other respects the same, is immediately attended with the circulation of an electrical current far more powerful than the thermo-electric current above mentioned. A great number of combinations of other metals were successively tried in various ways, and they uniformly gave the same results as those of iron and platina. Similar experiments were then made with various metallic compounds, and also with other chemical agents; and in all cases the same general fact was observed, namely, that when no chemical action took place, no electrical current was excited; thus furnishing, in the opinion of the author, unanswerable arguments against the truth of the theory of contact. The only way in which it is possible to explain these phenomena on that theory, would be by assuming, that the same law of compensation as to electro-motive power is observed by the sulphuret of potassium, and the other fluids of corresponding properties, as obtains in the case of the metals, although that law does not apply to the generality of chemical agents; and, in like manner, different assumptions must be made, in order to suit the result in each particular combination, and this without any definite relation to the chemical character of the substances themselves; assumptions, which no ingenuity could ever render consistent with one another. At the conclusion of the paper, the author describes some remarkable alternations in the phenomena which occur when pieces of copper, or two pieces of copper and silver, or two of silver, form a circle with the yellow sulphuretted solution, and which leads to the same conclusion as the former experiments. If the metals be copper and silver, the copper is at first positive, and the silver remains untarnished; in a short time the action ceases, and the silver becomes positive, at the same time combining with sulphur, and becoming coated with sulphuret of silver; in the course of a few minutes, the copper again becomes positive; and thus the action changes from one side to the other in succession, and is accompanied by a corresponding alternation of the electric current.

It may be proper to state, that we are indebted to the "Athenæum" for the foregoing report.

BURNING COAL MINES.

Letters and papers from the department of the Allier, bring accounts of a remarkable conflagration which broke out in the coal mines of Commentry, on Sunday, the 15th ult., and had been burning for a week with daily-increasing fury. It appears that this fire, which, for the last four-and-twenty years, has been silently smouldering in the bowels of the earth—revealing its existence by perpetual smoke, and occasional outbreaks of flame, which, however, had always been confined within the limits abandoned to its dominion—had, at length, made its way through some breach into one of the vast galleries of these extensive workings; and there, meeting with the air current so long denied it, had spread through all the subterranean chambers and passages with a rapidity, before which resistance became utterly powerless; showing itself at every crevice and outlet of the vast labyrinth, and flinging its points and columns of fire far up into the air, through all the shafts that led into the wide field of the rich deposit. Luckily, the solemnities of the day had emptied the workings of their human tenants; for no mortal aid could have availed them against the suddenness with which the fiery flood swept over all things. The authorities of the district were early on the spot, but have hitherto been little more than idle and awe-struck spectators. Neither Vesuvius, nor any other irruption, say the accounts, can give a notion of the dreadful and sublime scene. "If," says one writer, "it were possible to forget that the flames have been, for three whole days, devouring immense wealth, and that by this conflagration three hundred fathers of families will be thrown out of employment, there would be room for no other sentiment than that of admiration at the magnificent spectacle. Imagine a deep ravine, nearly circular, in the form of a reversed cone, with its edges, however, hourly enlarging. Through fourteen large openings, issuing at about twenty feet above the ground of this ravine, and giving access to the innumerable galleries of the mines below, as many

torrents of flame are poured forth with frightful violence from the cauldrons within—flames of a thousand hues, rushing forth like fiery whirlwinds—dividing, and crossing, and mingling, and rising, and falling, and rising again! At times, a hollow cracking sound echoes through the abyss; this is some huge block of coal detaching itself from the roof or sides of one of the galleries, and falling into the blazing gulf. Then rises up a thick column of black dust, till it reaches the openings of the galleries, where, pierced in all directions by the flames, long serpents of fire work through its volume from side to side. Sixty feet higher up, on each side of the galleries, two gaping mouths shoot into the air their dazzling columns of fire. Suddenly one of these ceases. It seems, for a moment, as if checked in its wrath. Then comes a long and startling groan from the entrails of the earth; and forth again rushes the flame, blood-red, roaring and terrible, threatening, in its fury, to lift up the burning mountain altogether, and bury the spectators beneath its dreadful ruins. Again, look around you; it is midnight, and two thousand human faces are there, some grouped on the opposite crest of the ravine, some sheltered in the cavities of the rocks. Yet no sound meets the ear save that of the roaring flames." The latest accounts state, that the rafters of the galleries had all fallen, and the founts of flame nearly ceased to play. The whole had become one huge burning gulf. The loss is said to be incalculable; millions of hectolitres of coal had been consumed. The engineers were preparing to turn the course of a stream, which flows at a league's distance, and direct it upon the burning mountain. Workmen were employed night and day in this operation, by which it was hoped to lay the mines under water.—*Athenæum.*

MICROSCOPICAL SOCIETY.

A PAPER was read by Mr. Edwards, "On the Structure and Affinities of the Bacillariæ of Ehrenberg." After commenting on the polygastric characters of these animalcules, the indestructible nature of their siliceous coverings, and their mode of reproduction by spontaneous division, the author proceeded to discuss the merits of these views, which have claimed for the Bacillariæ, on the one hand, a place in the vegetable, and, on the other, a position in the animal kingdom. The mixed nature of the phenomena exhibited by these animalcules, which has also led some naturalists to consider them as in one stage of their existence, animals, and in another, vegetables, furnish, according to the author, sufficient grounds for considering the Bacillariæ as an osculent group, uniting the two great kingdoms of nature.

DUBLIN MECHANICS' INSTITUTION.

THE directors of the above Institution have issued an address to the working classes of the city of Dublin. As the conditions it offers, and the inducements it holds out, especially to the poorer class of working men, are very nearly the same as those in most of the English institutions, we produce it here, with the hope that it may tend to promote the success of those societies which we believe to be calculated not only to amuse and instruct, but materially and permanently improve the social condition of the working classes at large.

"ADDRESS.

"Friends and Fellow-countrymen,—We address you upon a subject that concerns you all, whatever trade you may follow, or whatever opinions you may hold. We have nothing to say that will offend any man among you; nothing that you cannot readily comprehend. Listen to us, then, for a very few moments, and see if what we tell you of may not be worth your while to know.

Two years ago, there was not in the entire city of Dublin a single room where a working man could go in the evening, to read an amusing book, or to learn anything new in the way of his trade. Many of you are, perhaps, unaware that any such institution exists now. It is our pleasure and our pride to tell you that there does; that one of the finest buildings in your beautiful city is devoted exclusively to the amusement and instruction of the operatives of Dublin. Come, then, and judge for yourselves what we are doing to improve one another, and whether you might not do worse than join us. Remember we are not speculators, telling you what *might be done*—we ask you to look at what we *have done*, and at what we *are doing*. Plain men, like yourselves, with very moderate means, but, putting together each man what he can spare, we have enough to accomplish a great many good things.

The Mechanics' Institute is an association for mutual instruction founded by mechanics, composed chiefly of mechan-

ics, regulated by mechanics, and, in the main, supported by the subscriptions of mechanics. Every man who pays half-a crown a quarter is a member. We, as well as you, know how hard the times are; but still, half-a-crown a-quarter is only twopence halfpenny a week; surely that is not too high a charge for admission to as good a reading-room—as well lighted, and as well supplied with every new and useful publication—as any in the kingdom; for the use, besides, of a well-chosen lending library, containing one thousand volumes of practical and amusing books; and, for admission to several courses of lectures during the year, upon various subjects, by men of ability and character. Is all this dear at half-a-crown a-quarter?

We have been trying the benefit of this mode of spending our leisure time, after business hours, as we told you, for now nearly two years; and we find ourselves amply repaid in more ways than one. We belong to different branches of trade ourselves; and what serves one cannot but serve another. We all contrive to benefit by the means of information thus placed within our reach; and we are convinced, that if you were to try, you would be benefitted also.

Surely it is time that men should cease labouring as mere unthinking, unreflecting machines? Ought not every man to know and understand the design and theory of the work he is helping to complete? Knowledge makes labour light, and enables a man to avail himself of every suggestion that the experience of other men may furnish. And let none say that the time for improvement is past. No one who is able to work is too old to learn. The acquisition of knowledge, from the increased means of enjoyment which it opens, is well worth a little exertion to attain. Do not allow the vast stores of knowledge, which are daily accumulating, to lie neglected, when, by acquiring a portion for yourselves, you may keep pace with those who are advancing in practical information, and, consequently, in respectability, influence, and worth, by their increased capabilities for conferring benefits upon their fellow men and themselves.

For the improvement of apprentices, and of those mechanics who have no other opportunity for obtaining such instruction, we have already succeeded in establishing evening classes, under competent masters; one for architectural and mechanical drawing, the other for instruction in those branches of arithmetic and geometry, that are not taught in the common schools. No young man who is ambitious to fit himself for excelling in his particular department, can fail to see the advantages which are thus held forth to him. Other classes are in progress of formation.

The reading-room is open from two o'clock to five every day, and from seven to eleven o'clock in the evening. Many valuable periodicals, excluding those of a partisan or sectarian character, are liberally supplied. Do you think that a man, having spent the evening here in reading works of entertainment or instruction, will not feel better pleased with himself in the morning, than if he had spent the previous hours in dissipation?

For men with families, who prefer spending their leisure hours at their own firesides, the Lending-library supplies ample means of improvement and relaxation. Books of general literature, travels, fiction, history, and biography, in addition to the best writers on practical science, engineering, painting, building, dyeing, &c., and works of design, are lent out to the members generally.

Every member is free to all the lectures, and he likewise enjoys the privilege of bringing with him his wife or any female relative.

Lectures have, during the last year, been delivered on "Chemistry applied to the Arts and Manufactures," on "The Steam-engine," on "Natural Philosophy," &c., by Professor Kane, Surgeon Lover, and other gentlemen. It is intended that lectures will be repeated on these, or on such other subjects of a scientific and improving character as may appear advisable.

Every person paying annually or quarterly his subscription to the Institute, thereby becomes a member, and is entitled to all the privileges which have been already enumerated; and is eligible, after six months, to be chosen a member of the Board, one-half, at least, of whom must be operative mechanics.

Every person desirous of belonging to one of the classes, must pay half a-crown per quarter in addition, for each class.

Can anyone assign a single good reason why every working man in Dublin should not become a member of the Mechanics' Institute?

(Signed on behalf of the Committee),

ZECHARIAH DOWLING,
Secretary."

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 244).

BISMUTH.—71.

This metal was known as early as 1520. It has a reddish-white colour, and a brilliant lustre. Its structure is crystalline, and it may be obtained in regular eight-sided crystals. Its specific gravity is about 10. It is brittle when cold, but may be hammered into plates when hot. It fuses at 476°.

Bismuth is readily oxidized and dissolved by nitric acid, forming a transparent and colourless solution, called the nitrate of bismuth; by pouring this into water, a delicate white powder is precipitated, which is a subnitrate. From its pearly whiteness, it is sometimes employed as a cosmetic for improving the complexion, and is sold by the perfumers under the name of pearl powder.

ANTIMONY.—65.

This metal was discovered by Basil Valentine, in the fifteenth century. It is a greyish-white brittle metal, having considerable lustre. Its specific gravity is 6.7. It melts at 810°, which is the temperature at which bodies become luminous in the dark. It is a crystalline metal, and may be obtained by slow cooling from a state of fusion, in regular eight or twelve-sided crystals.

Metallic antimony is known in commerce under the name of regulus of antimony, and is extensively used in the manufacture of printing types, which are made of an alloy of lead, antimony, and tin. The medium proportions used by type-founders in this city are, twenty parts by weight of lead, four of antimony, and one of tin. The same alloy is also employed in the stereotype plates, but it contains a larger proportion of lead. Antimony is also used in the block tin and Britannia ware.

There are three definite compounds of antimony and oxygen; the first is denominated the oxide of the metal, the second antimonious, and the third antimonic acid. The first unites with acids, forming salts. The sulphuret of antimony is the only ore from which the metal is obtained.

ARSENIC.—38.

This metal is generally found associated with others, and especially with cobalt and iron. The term arsenic, however, as generally used, denotes an oxide of this metal, while the metal itself is known in commerce under the name of cobalt, or metallic cobalt.

Obs. The application of the term cobalt to metallic arsenic, has probably arisen from the fact, that the ore which contains the latter is an ore of cobalt, and is reduced chiefly for obtaining zaffre and smalt, which are varieties of the oxide of that metal. On roasting such ores in a reverberatory furnace, the arsenic, from its volatility, is expelled, combines with oxygen as it rises, and condenses in thick cakes on the cooler parts of the chimney. The sublimed mass, after being removed and purified by a second sublimation, is the virulent poison known by the name of arsenic, white arsenic, white oxide of arsenic, and ratsbane. From this substance the metallic arsenic is obtained, by heating it with charcoal.

Arsenic is an exceedingly brittle metal, of a steel grey colour, crystalline structure, and has the specific gravity of 5.88. It is not easily fused, but when heated to 356° it rises in vapour, which has a strong odour of garlic. This property distinguishes arsenic from every other metal.

Chemists are acquainted with two compounds of arsenic and oxygen; both have acid properties, and are denominated arsenious and arsenic acid; the former consists of two atoms of metal, and three of oxygen; the latter of two of the metal, and five of oxygen.

Arsenious acid, as before stated, is the white arsenic of commerce, so frequently used as a poison, and is one of the products from roasting the ores of cobalt, and may be obtained by heating the metal in air. It is generally sold in the state of a fine white powder, but, when first sublimed, it is in the form of brittle masses, colourless, and almost as transparent as glass, but, by exposure to the atmosphere, the surface of the mass becomes opaque. It is said to have a weakly acrid taste, leaving a slight impression of sweetness. It changes vegetable blues to red. Arsenious acid generally forms a part of the ingredients of the plasters used by quacks for removing cancers. It is used for destroying troublesome animals, such as rats, and hence it is frequently called ratsbane. It is considerably used in glass-making, and for producing white enamel, and the white figures on porcelain.

Obs. The following method has been proposed by Brugnatelli for discovering arsenic and corrosive sublimate in their respective solutions, and to distinguish them from each other:—We must take the starch of wheat boiled in water, until it is of a proper consistence, and recently

prepared: to this is to be added a sufficient quantity of iodine, to make it of a blue colour; it is afterwards to be diluted with pure water, until it becomes of a beautiful azure. If to this azure-coloured solution of starch we add some drops of an aqueous solution of the oxide of arsenic, the colour changes to a reddish hue, and, finally, is quite dissipated. The solution of corrosive sublimate, poured into the iodurretted starch, produces in it almost the same change with the arsenic; but if, to the fluid discoloured by the oxide of arsenic, we add some drops of sulphuric acid, the original blue colour is restored with more than its original brilliancy; while the colour of the fluid that has been discharged by the corrosive sublimate, cannot be restored, either by the sulphuric acid, or by any other means.

Arsenic acid also combines with bases forming salts, called arseniates.

There are two combinations of sulphur with arsenic found in the mineral kingdom, and known by the names realgar and orpiment; orpiment has a bright lemon yellow colour, and was formerly much used as a pigment, both in oil and water colours, under the name of king's yellow. It is poisonous, though less so than the arsenious acid. Realgar, which is the protosulphuret, is composed of one atom of metal and one of sulphur, while orpiment is composed of one atom of metal and one and a half of sulphur, or, to express the same proportions in whole numbers, it may be considered as composed of two atoms of metal and three of sulphur.

COBALT.—29.

Cobalt is a brittle metal, of a reddish-grey colour, and feeble metallic lustre. It is attracted by the magnet; its specific gravity is, according to Turner, 7.83.

Cobalt, as before stated, is generally associated with arsenic, and frequently with iron. The mines which yield the ores are chiefly wrought for the oxide of cobalt, of which there are two varieties, known in commerce by the names of zaffre and smalt.

The ore is roasted in a reverberatory furnace, and most of the arsenic is expelled in the state of vapour, and an impure oxide of cobalt remains, called zaffre, in which state it constitutes an article of commerce. On heating this substance with a mixture of sand and potash, a beautiful blue-coloured glass is formed, which, when reduced to powder, is known by the name of smalt, and is sometimes called cobalt blue and azure.

Smalt, in the state of a very fine powder, is extensively used in the arts as a pigment.

Obs. 1. It forms the colouring matter of the blue earthenware; the figures are first printed from copper-plate engravings on silvered paper, and applied to the ware before the glazing is put on. The colouring matter of the print adheres to the ware by a little pressure; water is afterwards applied, which softens the paper so that it may be removed, and leave the coloured figure, which is afterwards covered with the transparent glazing.

Smalt is used to give a variegated blue in sign painting. It is also employed in paper staining. It is considerably employed by the manufacturers in finishing cloths, laces, linens, muslins, threads, &c., to impart a delicate blue, or to conceal some other tint. In France, it is extensively used by the laundresses, who mix it with starch, for the same purposes as above mentioned.

The oxide of cobalt is readily dissolved in acids. When the muriatic acid is used, a delicate sympathetic ink is formed, which is invisible when cold, but acquires a beautiful grass green when warmed.

Illust. 1. A good sympathetic ink may be formed, by heating one ounce of zaffre with four ounces of nitric acid for about two hours, keeping the liquid at the temperature of 212°, and then adding one ounce of common salt, and four ounces of water, and filtering the solution.

2. Paper fire-screens are sometimes adorned by drawings of trees, whose trunks and leafless branches are sketched in India ink (a winter scene), and the foliage is made with the invisible solution of cobalt; on bringing it near the fire, the green leaves at once appear, and spring returns.

NICKEL.—29.

Nickel is a white metal, whose colour is intermediate between that of silver and tin, and is both ductile and malleable. It has a strong metallic lustre, and is attracted by the magnet. Its specific gravity is between 8 and 9. It is less fusible than pure iron, and suffers no change by exposure, at common temperatures, to air, whether dry or moist.

Nearly all the nickel that is used, is obtained from the ores of cobalt, in the process for preparing zaffre and white arsenic, and is found in combination only with metallic arsenic, in a melted mass, in the bottom of the crucibles in which zaffre is prepared. This melted mass is called speiss, and it is from this that pure nickel is obtained. The chief use of nickel is in

the manufacture of the alloy called German silver, which is substituted for pure silver in the fabrication of various domestic articles.

CHROMIUM.—28.

This metal has a yellowish-white colour and a feeble lustre. It is brittle and infusible, and takes its name from the Greek word *kroma*, signifying colour; because its compounds constitute some of the finest mineral colours.

There are two compounds of chromium and oxygen. The first is an oxide of a dark-green colour, and is composed of 28 parts, or 1 equivalent of the metal, and 12, or 1½ of oxygen. The second combination forms an acid called chromic acid, and is composed of 28 parts, or 1 equivalent of the metal, and of 24, or 3 equivalents of oxygen.

Chromic acid is a crystalline compound, of a dark ruby-red colour, and unites with the oxides of metals and with ammonia, forming salts called chromates.

GEOMETRICAL QUESTION.

To the Editor of the Mechanic and Chemist.

SIR,—Although I am anxious at all times to be corrected when I *am* "mistaken," yet I cannot admit that I am mistaken in what I have written respecting my pedestrian question. I have submitted the question to friends, on whom I can rely, and they cannot conceive the possibility of a doubt as to my being correct. It is perfectly true, as stated in your notice to correspondents in No. 85, that L *l*, &c., are equal spaces, and P *p*, &c., are equal spaces; but it does not follow that *p l*, &c., are parallel to P L, nor will they all point to the north. I suspect, from the erroneous reasoning, that the writer of the notices to correspondents and "L. L.", are identical.

However, to put the matter beyond the doubt of a child, if you place yourself in one corner of a large room, and place your boy in another corner on the same side, and he move towards the corner opposite to you, do you mean to contend, that if you move continually towards the boy (who is always progressing and changing his place), you will move in a *straight line*? Or, which amounts to the same thing, can you for a moment contend, that if you walk direct from the corner in which you are placed, to the opposite corner, you will be continually moving towards the boy, although he is only travelling towards such last corner? Either of these positions is preposterous, and yet these are the positions which you and "L. L." contend for!

It might as well be said (and the cases are parallel), that because a planet is retained in its orbit by centripetal and centrifugal forces (each of which, taken alone, is a *rectilinear* force), it will not move in a curve, but in a straight line! This, we know, is not the case; and it is equally clear that the pedestrian must move in a *curve*, and *not* in a straight line.

Your and "L. L.'s" error consists in assuming a point where the two parties are to meet, from the rates of their travelling, and is, in fact, nothing more than an answer to the following question, scarcely fit for the consideration of a schoolboy of ten years of age:—"If A is distant from London eight miles, and B is distant from London $\sqrt{8^2+6^2}$ miles, and A travels four miles an hour, and B five, how long will they be before they reach London?" *Ans.* "Two hours." Of course, this is all that can be made of "L. L's" solution. The question to which he gives the answer is similar to the following:—"A and B are fifty miles asunder, directly east and west, and are each travelling in a straight line to a place directly north of B, so situated, that if B travels three miles an hour, and A four miles an hour, they will both reach it at the same time. How far distant is the place from A and B respectively?" But, in such a case, it can never be said, as in my question, that A is travelling towards B, for he is continually travelling direct to a place in advance of B, and to which B is also travelling. In fact, the matter is too clear to waste farther words about it. But, after all, I should like to see a correct and concise solution to my question. W. N.

[We repeat that "W. N." is utterly mistaken, and a correct and concise solution to his question has already been given. Our answers to correspondents are not, as he surmises, supplied by correspondents; and we know no more of "L. L.", than that he favoured us with an accurate, though somewhat too brief solution of the above problem. "W. N." appeals from our decision; he has a right to do so; and if he can persuade "L. L." and the rest of our mathematical readers, that two lines, near together, and each pointing to the north, are not to be considered as parallel, then, indeed, the question would assume a new aspect; but, unless this be conceded, P C is evidently a straight line. "W. N." appears to forget, that the light was to be continually due north of the traveller.—ED]

THE CHEMIST.

ON ALKALIES.

(Continued from page 235.)

Brucia (Vegeto).—This alkali received its name from Mr. Bruce, the Abyssinian traveller, who first made known the tree, the false angustura, from the bark of which the alkaline substance is obtained. The bark is powdered and digested in ether, which frees it from oily matter; it is then treated with alcohol. This solution is then evaporated, which leaves impure brucia. To purify it, it must again be dissolved in water, and saturated with oxalic acid, then evaporated to dryness; the colouring matter is then removed by alcohol, and leaves pure oxalate of brucia, which is decomposed by lime; and the brucia may be taken up in a free state by boiling alcohol, from which it may be obtained by slow evaporation in the form of crystals. In this state it is a true hydrate, which, by fusion, loses a considerable quantity of water. Brucia is intensely bitter, is sparingly soluble in water, fuses at a temperature near 212° Fah., and, on cooling, looks like wax. Exposed to moist air, it swells, and becomes pulverulent. It combines with acids, forming neutral salts. Mr. Liebeg's analysis of brucia is as follows:—

Carbon.....	70.88
Nitrogen	5.07
Oxygen	17.39
Hydrogen	6.66
	100.00

Cinchonia (Vegeto).—To obtain this alkali, the alcoholic extract of the grey bark of cinchonia * is to be entirely dissolved in boiling water, strongly impregnated with hydrochloric acid; calcined magnesia is then added in excess, to fix the colouring matter; it is allowed to cool, filtered, and the magnesian precipitate washed with cold water. The precipitate having been dried on a stove, is to be repeatedly treated with alcohol, in order to dissolve all the bitter matter. The alcoholic liquors are now mixed, and the cinchonia crystallizes on cooling. It is white, and soluble in 700 parts of cold water. When dissolved in alcohol, and still more in an acid, its taste is very bitter. It unites with acids, forming salts, more or less soluble. When it is heated in a glass tube, it evolves ammonia. Some years back, MM. Pelletier and Dumas analyzed cinchonia, which afforded them

Carbon.....	78.67
Hydrogen	7.06
Oxygen	5.16
Nitrogen	9.11
	100.00

Codeia (Vegeto) was discovered by Robiquet in 1832. In treating a solution of opium with muriate of lime, muriate of morphia is precipitated in combination with another substance, which is codeia. From this precipitate the latter is separated by ammonia; the major part of the morphia is precipitated. The supernatant solution of codeia, with some non-precipitated morphia, is concentrated, until the chlorohydrate of ammonia begins to crystallize, and with it the double salt of morphia and codeia. The crystals are to be dissolved in water, and filtered through animal charcoal; a slight excess of caustic potassia is then added, by which means the codeia alone is precipitated. It is then taken up by alcohol or ether, which yields it pure by evaporation. Codeia is insoluble in alkaline solutions; it combines with acids, forming neutral salts, which are decomposed by tannin. According to M. Robiquet, it is composed of

Carbon	71.339
Nitrogen	5.353
Hydrogen	7.585
Oxygen	15.723
	100.000

G. W. S. Piesse.

* Peruvian bark.

IMPROVED CHEMIST'S MORTAR.

To the Editor of the Mechanic and Chemist.

Sir,—It is well known, that in pulverizing drugs, a considerable portion is lost, besides the offensive odour that arises, from some—aloes, for instance. I think the following simple plan would effectually remedy the evil:—Take a piece of fine cloth, make it in the form of a bag, but open at both ends; one end should be made wide enough to slip over the top of the iron mortar, round which should be fastened a thin band of India-rubber, rather smaller than the top of the mortar, so as to slip over it; the other end of the bag should have a small ring of the rubber fastened to it, so as to slip over the pestle; so that when one end is slipped over the top of the mortar, and the other over the pestle, not a particle of the powder can escape; and it does not in the least prevent

the action of the pestle, or cause a loss of time, as it can be taken off in a moment. I have made one myself, and have used it for several years, and the expense is only trifling.

I remain yours, &c.,
J. THOMSON.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 15, W. Rider, Esq., on Engraving. Friday, April 17, Institution closed. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, April 15, Quarterly General Meeting. At eight o'clock.

Poplar Institution, East India Road.—Tuesday, April 14, T. Archer, Esq., on Igneous Geology. At eight o'clock precisely.

QUERIES.

1. What composition is that which will change any coloured hair a jet black? 2. What will make the hair curl? 3 How to make the white shaving soap, such as is commonly sold in the shops? A. H. D.

Coventry.

[The first question has been so often asked and answered in the "Mechanic," that we are compelled to decline saying anything more about it; we, nevertheless, leave it open for any of our correspondents who can describe a method superior to the nitrate of silver. We do not think that "a hair-dresser" would be benefitted by speculating in soap-boiling; but he might find some advantage in adding a little sweet oil to lather; this is, in the language of old writers of receipts, "proved."—ED.]

How to make the writing-fluid, that, at the time of using, is of a greenish blue, but soon turns a deep black? J. M. H.

How to stain white whalebone blue or green? J. H.

How to make yeast different from that which is procured at the brewers? W. T.

How to obtain fluoric acid? T. WEST.

Can any of your correspondents inform me what to put with glass to make it melt easier?—(Borax.) How to make bird-lime? What to put in bread seals to prevent their cracking? I have found putting them in a cold place does not effect the object. W. V—E.

The best method of staining leather, or, at least, the ingredients I should use, to produce a sky blue and a grass green? A. Z.

ANSWERS TO QUERIES.

To make Blue Ink.—Prussian blue, ¼ oz.; oxalic acid, ½ oz.; water, 16 oz.. The above keeps its colour, and is not affected by acids, though, of course, it will not stand a strong alkali. J. M. H.

"V. Knox." "1. Why is the apparent brightness of a star increased by the use of a telescope, while that of a planet is not?" This, I conceive, arises from the fact of the planet, when viewed through a telescope, being magnified in *size*, while a star is only magnified in *lustre*; it not appearing through a telescope to be increased in size, but to still remain a mere point.

[The intensity of the light emitted by a star, is estimated at about 300,000 times greater than that of a planet. If a star does not appear to the naked eye so bright as when magnified by a telescope, it is because our organs of vision cannot appreciate the impression of so extremely small an image.—ED.]

"2. Why are some stars visible only at particular seasons of the year?" Because, by the apparent motion of the sun in the ecliptic, all stars (except those circumpolar stars, which are always above the horizon) rise and set nearly four minutes earlier every day. Therefore those stars (except as above mentioned) which are now visible in the night, will, in six months hence, be above the horizon in the day time, and will, consequently, be then invisible, because of the sun's light, and *vice versa*.

"3. How the *apparent* place of a star, at any time, is calculated from its mean place at the beginning of the year?" A full answer to this would occupy too much space. In the first place, we must find the *mean* place at the given time by the annual variations in right ascension and declination. To this the proper corrections must be made for precession, aberration, and nutation, and we shall have the *true* place of the star. The altitude of the star for the given time and place may then be found, and that increased by the refraction in altitude, will be the star's *apparent* place. The correction for refraction, however, is not necessary in occultations and near approaches of a star to the moon, &c., as both sides are then affected by it equally. "V. Knox" will find the necessary tables for the above corrections, in "Galbraith's Mathematical and Astronomical Tables," which is a very useful work.

W. N.

"S. C." "There was an occultation of the star α Leonis by the moon; the time for Greenwich was 7 h. 10 m. immersion, and 8 h. 21 m. emersion; would there be any difference, and what the difference, between the time at Greenwich, and in 50° 36′ north latitude, and 2° 27′ west longitude?" It is impossible, from the question *as stated*, to give a *correct* answer. In consequence of the large parallax of the moon, her *apparent* places, as seen in different latitudes and longitudes at any given moment, will always be different. The only *correct* way of solving "S. C's" question is, to compute the times of the immersion and emersion for the given place; which is a work occupying considerable time and space. (See any work on practical astronomy or spherical trigonometry, or Galbraith's book above referred to.) The difference in actual time asked by your correspondent is trifling; but, as the motion of the moon in the zodiac is

from west to east, the more westerly the place, the earlier the occultation takes places. However, your correspondent must recollect, that to obtain the time on his meridian, it is necessary to subtract from the Greenwich time, 9 m. 48 s., answering to the difference of longitudes. That is, that the occultation, as observed at Greenwich, commences at 7 h. 0 m. 12 s. Weymouth time, and ends at 8 h. 11 m. 12 s. Weymouth time. Being an amateur astronomer myself, I shall be happy at any time either to give (so far as is in my power) or to receive any information or assistance in astronomy, either through this work, or by letter in a private way.

W. N.

To Stuff Birds.—The principal beauty of stuffed birds, consists in their being well shot; for the large species, ball-shot from a rifle should be used, and, for smaller ones, dust-shot. As soon as one is killed, a little wool should be laid upon the bleeding orifice, the feathers laid in order, and the head wrapped up in tow; it should then be packed in hay, and then quickly conveyed home. You then lay it upon a clean cloth, and part the feathers of the breast and abdomen; then divide the skin, taking care not to soil the feathers from the breast to the rent; or they may be opened under the wing: and those who have beautiful breasts, as the divers, &c., may be opened on the back. Separate the skin from the muscles and cellular tissue, by means of the finger or a blunt instrument. Push up the thighs, and deprive them from the flesh, and break the bone about its middle; draw the skin over the body, and remove it also from the wings to the second joint; treat them as you have done the thighs; then turn the skin over the head, and remove the occipital part of the skull, so that you may be able to scoop and wash out the brain. Remove the eyes, dissect away as much flesh as possible from the skull, and, when you have finished shining it, rub the skin over with chalk, to remove adipose matter; wash it clean with a sponge and warm water, then cover it all over with either the following solution, powder, or soap:—

Solution.—Muriate of mercury, 1 oz.; alcohol, 8 oz.

Powder.—Muriate of mercury, ½ oz.; burnt alum, ½ oz.; tanner's bark, 3 lb.; camphor, 4 oz.

Soap.—Camphor, 5 oz.; arsenious acid, 2 lb.; white soap, 2 lb.; subcarbonate of potass, 12 oz.; powdered lime, 4 oz.

To keep the Hands from Chapping.—Tincture of Peruvian balsam, 2 oz.; tincture of benzoin, 1 oz.; tincture of aloes, 1 oz.; hydrochloric acid, 10 drops.

MANIPULATOR.

The title of the work to which "R. H. S." alludes, is "The Cabinet-maker's Guide," in which he will find the information he requires. There are two works under this title; the first of which was published anonymously, and printed by or for Knight and Lacy, Paternoster Row; the second, which is little more than a reprint of the other, except the article on upholstery, is edited by J. Stokes, and published by Dean and Munday, Threadneedle Street; however, I think the first will suit the purpose of "R. H. S." the best.

B. T.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the "MECHANIC AND CHEMIST" is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half-a-Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half-a Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press, 1, Long Lane, Aldersgate Street.*

Slaminann, Hamburgh.—*Has addressed to us a number of queries concerning certain reservoirs of water, but has omitted to explain what and where they are.*

I. Q. G. *in our next.*

F. M.—*Once more, the oxide of iron is the substance used for razor-straps, and as it may be obtained of various qualities, more or less mordant, it is well adapted to various similar purposes.*

B. Tongue.—*M. Daguerre announced some time ago, that he had succeeded in substituting silvered copper for the plated metal originally employed. We believe it is customary for country post-offices, to charge a halfpenny, for the conveyance of prepaid letters to isolated houses; but all such questions will probably be settled, when the measure is brought finally before the House at the end of the present sessions.*

Junius.—*Proposition* 1 *is correct; the* 2*nd. and* 3*rd. are untrue.*

I. C.—*The various nostrums, which are sold to make hair grow on bald places, are of no utility whatever, except to the sellers. It is generally supposed that uneasiness of mind is unfavourable to the preservation of the hair. The following recipe may be serviceable in some cases: take a pint of the finest old port, and, after dinner, slightly moisten the part therewith, and drink the remainder. If about half-a-dozen patients afflicted with the same complaint, assemble together daily, and persevere in the proposed remedy, they will soon experience and proclaim its efficacy.*

W. T's. *receipt is incorrect, and might, if through any oversight it had gone to press, have caused a great deal of mischief.*

S. S.—*If he will enclose the model, and write upon it "confidential" it will only be examined by one person.*

ERRATUM.—Page 258, for "p p'," read $p'p''$.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

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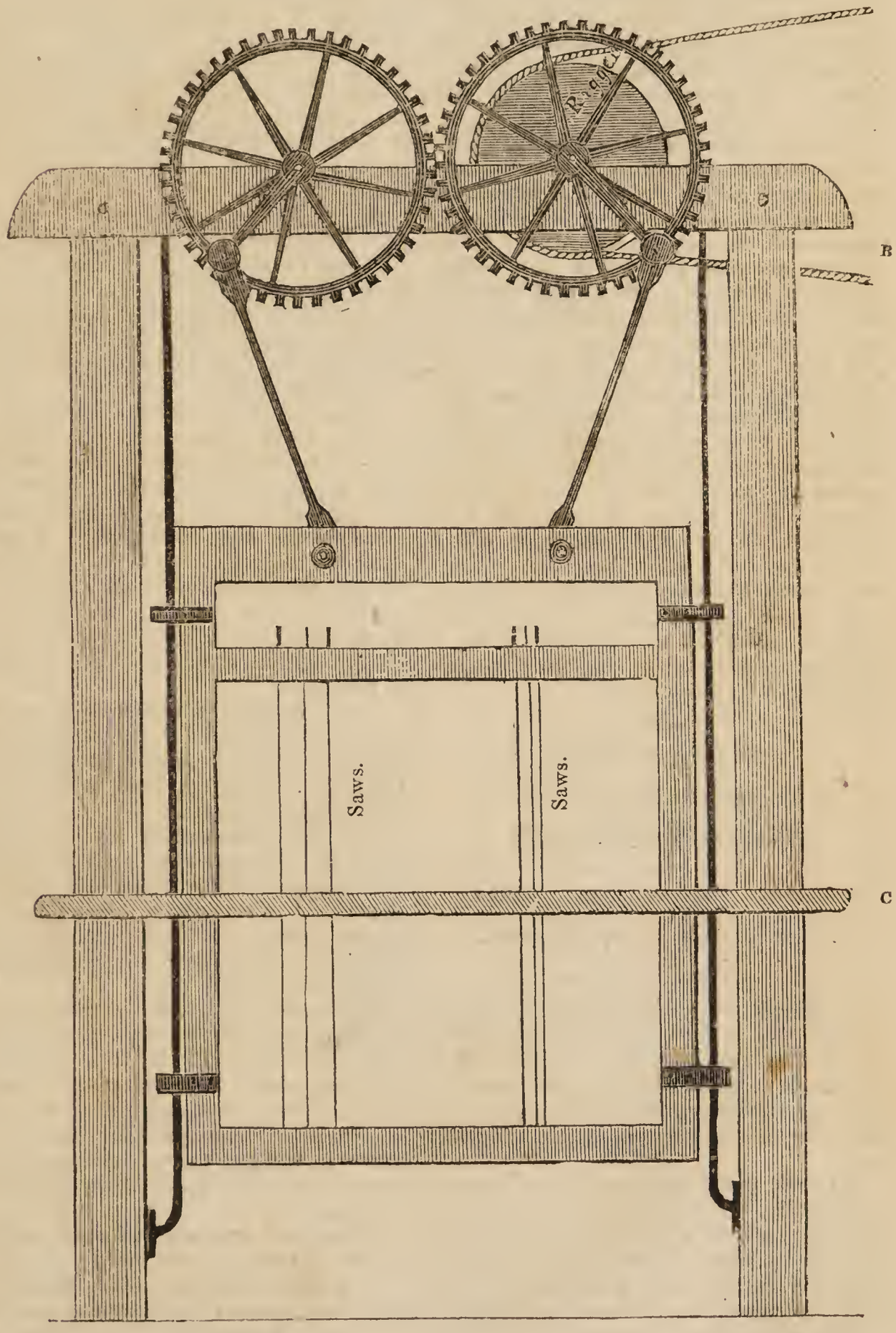
VERTICAL SAW FRAME.



Vol. V.—No. 39] City Press, 1, Long Lane, Aldersgate Street : D. A. Doudney.

VERTICAL SAW FRAME.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Never having seen in the "Mechanic and Chemist" any plan of a vertical saw frame, similar to the one annexed, I send you a plan of one of my construction; and would feel greatly obliged if you could inform me whether anything in this form has ever before been set in motion. My object is, to reduce the friction in the slides, which, in the common way, is very great, being generally worked by one crank.

You will perceive from the sketch, that the geared wheels revolve in reverse directions, and the upper cranks, which are firmly fixed to the axles of both wheels, elevate and depress the saw frame, without any material friction in the slides, working, as it does, in a true vertical line. B, the drawing-strap or cord; C, the bench; the scale, one inch to the foot. The one I am fitting up is on a small scale, having only a twelve-inch stroke. I have intended it to be fixed at the head of one of my carpenter's benches, for the purpose of sawing tenons, &c., in cabinet and joiners' work. If you think it worth your notice, by inserting it in the pages of your valuable work, called the "Mechanic and Chemist," I shall feel much obliged. Perhaps some of your numerous correspondents may wish to know more on the subject; if so, I shall be most happy to explain its working parts more minutely.

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 291).

THE MORE PERFECT USEFUL METALS.

Mercury, Gold, Silver, Platinum.

MERCURY.—200.

This metal is more commonly called quicksilver, a term given by the alchymists, who supposed it to be silver in a liquid state, rendered so by the presence of some substance, which they hoped to separate and obtain the silver in the solid form.

Mercury is the only metal that is liquid at common temperatures. It freezes at the temperature of 70° or 72° below that of freezing water, when it is malleable, and may be cut with a knife. At ordinary temperatures, its specific gravity is 13.54, but, when frozen, it is 15.61. Heated to 662°, it boils, and condenses again into a liquid on cooling. It is not oxidized by exposure to air at common temperatures.

The only acids that readily act on mercury, are the nitric and sulphuric; the former at common temperatures, and the latter only by application of heat.

Mercury is occasionally found in the native state, but more frequently in combination with sulphur, forming the compound known by the name cinnabar, which is the chief ore of that metal, and is reduced to the metallic state, by heating it with lime or iron filings, by which means the mercury is volatilized, and the sulphur retained in combination with the lime or iron.

Mercury is extensively used in the arts. Immense quantities are employed in the gold and silver mines, for the reduction of those metals. It is the chief liquid employed in barometers and thermometers. In combination with tin, it forms the amalgam used in covering the backs of looking-glasses.

Illust. This process is performed by pouring quicksilver on the glass in quantities sufficient to cover it, and then carefully placing over it a clean sheet of tin-foil, pressing it close to the glass, so as to force out the fluid quicksilver; a part of it, in the mean time, from its affinity with the tin, will have combined with it, forming an amalgam, which, after being pressed for twenty-four hours, to force out any remaining fluid quicksilver, adheres firmly to the glass.

Large quantities of mercury are used in the process called water-gilding. It is largely employed in the preparation of vermilion, red precipitate, calomel, corrosive sublimate, &c.

Obs. The quicksilver mines of Idria, situated in the southern part of Austria, yield annually 356,000 lbs. of quicksilver, 67,000 lbs. of vermilion, 1,600 lbs. of calomel, 700 lbs. of red precipitate, and 600 lbs. of corrosive sublimate, besides 19,000 lbs. of lump cinnabar.

There are two oxides of mercury; the protoxide is a black powder, and is composed of 200 parts, or 1 equivalent of mercury, and 8, or 1 equivalent of oxygen. The peroxide exists in shining crystalline scales, of a bright-red colour, and is composed of 200 parts, or 1 equivalent of the metal, and of 16, or 2 equivalents of oxygen.

There are two chlorides of mercury, which are extensively used in medicine. The protochloride, called calomel, and the bichloride, called corrosive sublimate. The latter is exceedingly poisonous when

taken internally, and is frequently used for destroying troublesome insects.

Corrosive sublimate is prepared by subliming a mixture of common salt, and bisulphate of mercury: the chlorine of the salt goes to the mercury, and the sulphuric acid of the mercury goes to the soda. Thus we have, as products, bichloride of mercury and sulphate of soda.

Calomel is prepared by subliming a mixture composed of equal weights of corrosive sublimate and pure mercury. The corrosive sublimate, which is bichloride, gives up one-half of its chlorine to the mercury, and the whole becomes a protochloride or calomel.

Obs. Calomel occasionally contains a little corrosive sublimate, which may be detected in the following manner:—Agitate the calomel with hot water, which has no action on the calomel, but if corrosive sublimate be present, it will be dissolved; now pour off the water into a wine-glass, and add a few drops of lime-water; if corrosive sublimate be present, an orange-coloured powder will be precipitated.

Bichloride is composed of 200 parts, or 1 equivalent of mercury, and 72, or 2 equivalents of chlorine, while the protochloride contains 1 equivalent of each element.

There are two compounds of sulphur and mercury. The protosulphuret is black, and the bisulphuret is red. The latter is formed by subliming a mixture of mercury and sulphur. The sublimed mass, when reduced to a powder, is the beautiful pigment vermilion.

Cyanogen combines with mercury, forming a crystalline compound, called the cyanide or cyanuret of mercury. This compound was formerly supposed to consist of prussic acid and oxide of mercury, and was called prussiate of mercury. It is composed of 52 parts, or 2 equivalents of cyanogen, and 200, or 1 equivalent of mercury; it is, therefore, a bicyanide. By heating this compound, it is decomposed, yielding cyanogen and metallic mercury. This constitutes the process described by chemists for obtaining cyanogen.

SILVER.—108.

Silver is frequently found in the native state, and also in combination with other metals and with sulphur. In the state of sulphuret, it is almost always contained in the lead ores; hence the lead of commerce generally contains a little silver.

The colour and lustre of this metal, from its use as a coin, are more familiarly known than most other metals. It is not oxidized by exposure to air and moisture at common temperatures. It is malleable and ductile, and, when pure, is so soft, as to be easily cut with a knife. Its specific gravity, when hammered, is 10.51. It melts at a full red heat.

Silver is extensively used in the arts for manufacturing various domestic articles, and is alloyed with about one-twelfth its weight of copper. The silver coin of the United States contains about one-ninth its weight of copper. It is extensively employed for plating on copper, and used in manufacturing plate ware.

Illust. 1. The English plate, much of which is manufactured at Birmingham, and hence is called Birmingham plate, is formed by soldering to a thick bar of copper, another of silver one-twelfth of the thickness. The compound bar is then passed between heavy iron rollers, and rolled out, so that the plating of silver over the copper, is said, in some cases, to be only one-thirty thousandth of an inch in thickness. The silver plate, as thus prepared, is used for manufacturing the silver bands on carriage-wheels, candlesticks, tea-pots, and various other articles.

2. The French plate is formed by covering the clean surface of the copper with silver leaf, which is burnished down with steel burnishers.

3. Thermometer and barometer scales are silvered, by first rendering the scales perfectly clean, and in that state rubbing them with a mixture of two parts of cream of tartar, two of common salt, half a part of alum, and half a part of silver in fine powder.

Silver is readily acted upon by nitric acid, which first oxidizes the metal, and then dissolves it, forming a nitrate, commonly called lunar caustic; lunar, from the ancient name of the metal, and caustic, from its rapid destruction of the skin and flesh wherever it is applied. This is frequently used by surgeons, and is prepared by fusing the nitrate and casting it in moulds, forming it into sticks about the size of a common quill.

ON ELECTRICITY.

NO. II.

(Continued from page 267.)

When about to prosecute a course of experiments, the machine should be brought out and placed at a short distance from a good fire, in order to render it thoroughly warm and dry; for it is a fact which cannot be repeated too often to the

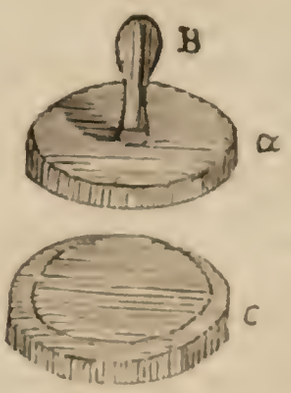
young beginner, that, unless the whole of the apparatus be in this condition, he will often be disappointed in the results of his experiments. Particles of moisture attaching themselves to the glass pillars, tend, in a great degree, to destroy their insulating properties, and, even when suspended in the air, tend powerfully to carry off electricity. When the glass is sufficiently warmed, the cushion is to be removed, and a thin coating of amalgam evenly spread over the whole surface, which tends greatly to increase the excitation; it should then be returned to its place, and the cylinder set in motion, which should always be in the direction of the silk flap. After a few turns, the cushion is again to be removed, and amalgam applied to any defective part. All that is above the line, where the silk flap joins the cushion, is to be separated from it; the silk flap, wiped clean, and the rubber returned to its place. Lastly, the whole of the apparatus is to be rubbed over with a warm silk handkerchief, and the machine may then be placed upon the table, ready for use.

While in this condition a copious flow of electric fluid will always be obtained; and, if the machine could be kept at the same temperature, the supply would not be diminished during a whole course of experiments; if not, the cylinder will soon cool, dust will accumulate on the machine, and render every exertion fruitless. This may be in some measure remedied, by having a warm silk handkerchief, or woollen cloth, in readiness, and well wiping, from time to time, the cylinder, conductor, and pillars; but a better method is, to place on the base of the machine, directly under the cylinder, a small box of sheet iron, supported on a proper stand, about six inches in length, three in breadth, and one in depth, having a lid to raise easily, into which is placed a piece of bar iron, of nearly the same proportions, heated to redness. This will diffuse as much heat as will be required; and, if another piece of iron of the same size be kept in the fire, to take the place of the other as it cools, a temperature will be maintained sufficient to keep the machine in good action.

The best amalgam for electrical purposes, is made by melting one ounce of tin and two ounces of zinc together, and in this state mixing them with six ounces of mercury previously heated, and then agitating the mixture in a mortar or iron box till cold. It is then to be reduced to a fine powder, and mixed with fresh lard, to the consistence of thick paste. Some recommend this not to be done till the amalgam is about to be used; but I have found, when this is the case, it is apt to make the cylinder greasy, and prevent a copious flow of electricity; it is, therefore, better to be done a few days previously.

THE ELECTROPHORUS.

Fig. 3.



This is a very simple instrument, and one which might almost be termed a small electrical machine; and as we have just been speaking of the apparatus required for obtaining electricity, we shall here briefly describe it, postponing, till a future Number, the laws by which it is governed.

It consists of two conductors, each about six inches in diameter, and half an inch in thickness, and an electric. The upper one, *a*, may be made either of a plate of metal or wood, covered with tin foil, well rounded at the edges, to prevent the escape of the electricity; it is furnished with a glass handle, B, by which it is raised. The lower plate, *a*, is similarly constructed, and is surrounded with a tin hoop, rising half an inch above its upper surface, for the purpose of containing the electric, which is composed of one pound of resin, three-quarters of a pound of shell lac, and half a pound of Venice turpentine, melted together, and poured within the hoop of the lower conductor, till it rises to the surface, and then suffered to congeal. When the instrument is about to be used, the surface of the electric is to be rubbed with a dry woollen cloth, and it will be excited negatively*; place the upper conductor upon it by means of the glass handles, and touch it with the finger, when it will be positively electrified, and if brought in contact with a conducting body, produce a spark. This may be done repeatedly, without the excitation being renewed, and small jars charged, as from the conductor of the electrical machine.

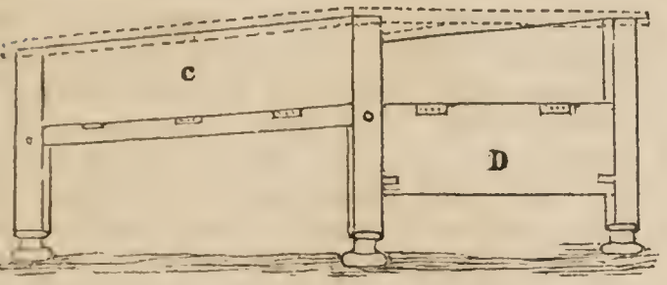
H. WIGLESWORTH.

* These terms will be explained in a future Number.

TABLE BEDSTEAD.

To the Editor of the Mechanic and Chemist.

SIR,—The accompanying is a sketch of a bedstead and table combined, which I have lately constructed for my library. The side flaps shut into the four posts, and a large flap or table-top (dotted in the sketch), fits on by a groove, forming, in the day-time, a table, and at night a bedstead.



A common French, or tent bedstead, can be altered to my plan. The flap, D, is shown open, and C shut.

I remain yours, &c.,

D. B.

REVIEW.

History and Guide for Drawing the Acanthus, and other Description of Ornamental Foliage. By I. PAGE. London: I. Page, Atlas Press; Berger, Holywell Street, Strand.

THERE is no art more generally applicable to the numerous branches of manufacture, than that of design; and yet it has been inconceivably neglected, both by teachers and writers for the working classes. A knowledge of the benefits which foreign countries have derived from an early and careful cultivation of this art, has at last directed the attention of Englishmen to the subject, and the most satisfactory results may be anticipated from the various popular schools of design, which are now established.

The volume before us contains a variety of engravings which will, no doubt, materially assist the student in ornamental drawing. The author is a practical man, and a master of drawing, and he claims the singular merit of writing and printing the book, and designing and engraving the numerous plates and wood-cuts. It may be regretted by some, that a better understanding does not exist between our author and Lindley Murray; but it should be recollected, that works of this kind are not intended as specimens of literary excellence, but merely as vehicles for the conveyance of useful information, to assist and direct the operations of practical men. We select the following passage as a specimen:—

"You learn more in two hours from a good lecture on any subject, when practically explained, than you would in a fortnight's labour; and why? the lectures of a profound scientific man open volumes before you; he has struggled, studied, attended institutions, and gone through the most difficult hardships and problems to arrive at an apex of perfection, and perhaps, in some instances, he has given two or three years' study and attention to one subject, and would willingly come and put you in the full possession of all in the same number of hours. How many are there at the present time, who are in duty bound to be thankful to Mr. Hayden, Dr. Birkbeck, and many others of lesser talent, for the knowledge they have arrived at? yet so trifling and easy a road for each description of studies they might wish to follow; and sincerely hope, in my department and description of the arts so to simplify it, on the true basis and principle, that you may derive the same benefits from my information, as others have done from much more scientific men, and whose affluent circumstances have placed it in their power to travel and study, when I could not; but trusting I have collected and seen sufficient, at least, not to misguide you, and to this end, the following paragraph is very appropriate, and, at the same time, I think no harm in noticing it, particularly when it is obtained from such an author:—

'From small beginnings, great conditions rise;
Act well your part; there all the honour lies.'"

THE CHEMIST.

CHEMICAL ANALYSIS.

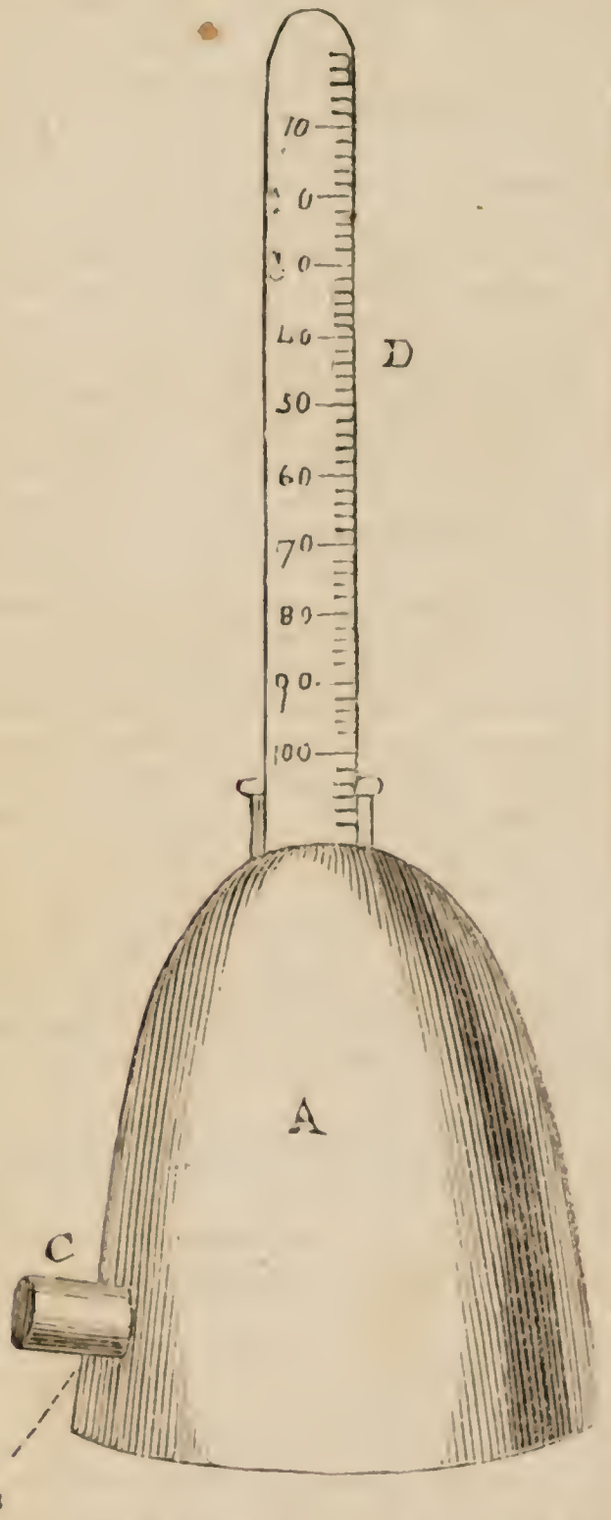
(Continued from page 258.)

AGREEABLY with my proposal in No. 83, I shall now briefly describe the usual manner of

Analysing and Determining the Quantity of Carbonic Acid in Gaseous Mixtures.—To know whether any mixture contains carbonic acid, may be readily ascertained by shaking it up in a bottle, containing a small quantity of lime or barytic water, when turbidity will readily appear; carbonate of lime or baryta being formed.

To determine the quantity of carbonic acid, an instrument is generally employed, known by the name of Hope's endiometer. It may be very easily constructed:—A bottle is first to be obtained, similar in

shape to A in the engraving; a hole must be drilled in the side, B, and a cork made accurately to fit, C, or a stop-cock inserted; a tube, D, of the capacity of one cubic



inch, is to be divided into 100 equal parts, and inserted into the neck of the bottle, where it is to be firmly secured. When required for use, the bottle is to be filled with lime-water, and the tube with the gas for examination; which may be done through the agency of the pneumatic trough. The contents of both bottle and tube are then to be briskly agitated; you then withdraw the cork, C, under water, when the liquid rushes into the tube, supplying the place of the gas, which has been absorbed by the lime-water, and which has formed carbonate of lime. Repeat the process as long as any absorption ensues. When the quantity of gas absorbed denotes the quantity of carbonic acid originally contained in the mixture.

MANIPULATOR.

(*To be continued.*)

LAUGHING GAS.

To the Editor of the Mechanic and Chemist.

SIR,—I think a much easier plan of producing the exhilirating effects of the nitrous oxide of Davy, is produced by sulphuric ether. The ether is to be introduced into a bag, and applied in the same manner as the protoxide of nitrogen. I have practised it upon myself, and find it answers exceedingly well; except that the ether produces a rather disagreeable taste in the mouth.

I remain yours, &c.,

MANIPULATOR.

ELECTRICAL EXPERIMENTS.

To the Editor of the Mechanic and Chemist.

SIR,—The few following experiments may, perhaps, be novel to some of your readers who are engaged with electricity.

Experiment 1.—Sprinkle a little powdered resin on the table of the universal discharger; when a strong charge is passed through the resin, it is suddenly inflamed, producing a flash similar to gunpowder; a black smoke, at the same time, curling up from it. The above effect will, of course, not be produced, unless the table of the discharger be covered with glass or some other non-conducting substance.

Exp. 2.—Pass a middling charge through a piece of moistened sponge; it is rendered luminous for a few seconds, giving out a beautiful rose-coloured light.

Exp. 3.—The influence of the electric fluid on the taste of several fruits, is well worth noticing, a good example of which is a raisin: after having been exposed to a single spark from a jar, it acquires a taste similar to one that has been smoked; that flavour is, of course, increased, if the raisin be exposed to a series of sparks.

Exp. 4.—Allow the charge of a jar or battery to pass over the surface of a cabbage leaf; the course of the electric fluid is marked by a shining appearance of that part of the leaf exposed to its action. If the leaf be kept for a day or two, the track of the fluid is observed from the part having turned quite brittle, and bearing a withered appearance.

A YOUNG EXPERIMENTALIST.

CHEMICAL AND PHILOSOPHICAL SOCIETY

FOR SHOREDITCH AND THE NEIGHBOURHOOD.

To the Editor of the Mechanic and Chemist.

SIR,—The provisional Committee of the above Society beg to state, through the medium of your Journal, that the arrangements for its opening are proceeding rapidly. Persons who wish to become members, are requested to forward their addresses either to Mr. Jeffs, 81, Shoreditch, or to me; and tickets for the introductory lecture will be duly forwarded to each. After the lecture, the quarterly tickets can be received.

H. WIGLESWORTH, Sec.

65, Tooley Street, Southwark.

SOLUTION OF PROBLEM.

Given $x^2 + 1 + \frac{x\sqrt{x} + \sqrt{x}}{2} = \frac{11x}{2}$;

Or, $2x^2 + 2 + (x+1)\sqrt{x} = 11x$. By transposition and division,

$\sqrt{x} = \frac{-2x^2 + 11x - 2}{x+1}$; and, by squaring both sides,

$x = \frac{4x^4 - 44x^3 + 129x^2 - 44x + 4}{x^2 + 2x + 1}$; or,

$4x^4 - 45x^3 + 127x^2 - 45x = -4$. Let $x = \frac{y}{4}$; then we shall have

$y^4 - 45y^3 + 508y^2 - 720y = -256$, where all the roots are positive.

And by trying the positive divisions of the last term, we shall find that 1 and 16 are two of them that produce an equality; therefore, they are two of the roots of the equation. Now, let the equation last found be divided by

$y^2 - 17y + 16 (= \overline{y-16} \times \overline{y-1})$, and we get the quadratic equation

$y^2 - 28y + 16 = 0$; whose roots are $14 \pm \sqrt{180} = 14 \pm 2\sqrt{45}$.

Therefore, the four values of x are 4, $\frac{1}{4}$, and $\frac{7}{2} \pm \frac{1}{2}\sqrt{45}$. L. L.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 22, Dr. Epps, on Phrenology. Friday, April 24, Charles Wood, jun., Esq., on Spain. At half-past eight precisely.

Poplar Institution, East India Road. Tuesday, April 21, J. Robinson, Esq., on Botany. At eight o'clock precisely.

QUERIES.

Light is stated to travel at the amazing velocity of 192,000 miles in a second of time; how is that ascertained? P. A.

How is it, that, on the equilibrium theory, in north latitude, the day tides are higher than the night tides during summer, and lower during winter? P. AMER.

I am about completing a model of a railway engine, but I am rather at a stand, being in want of the following information:—1. Not knowing exactly the shape of the boilers commonly used for models. 2. The exact place for the lamp. 3. From what part of the boiler is the feeding-pipe brought for working the cylinders?

A. T.

A receipt for the composition of stereotype plates? Also, what the moulds are made of, that they are cast in? Also, the method of making the inking rollers?

EXPERIMENTAL MECHANIC.

1. The best means of obtaining the vanishing points of perspective drawings, so as to make a perfect perspective view? 2. How to paint water-colours on satin? 3. The best substitute for glass to hold the conductor of an electrifying machine; wax will do, only that it so often breaks? 4. How to erase amalgam from gold or silver; as I find the more you rub it, the worse it is? 5. The best composition for making moulds for frames, &c.? J. RICHARDSON.

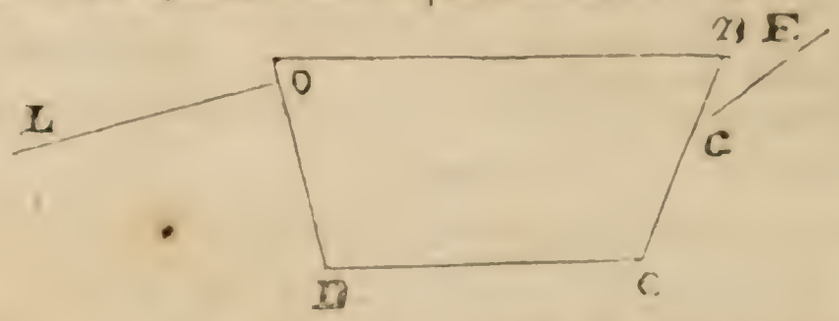
A method of cleaning kid gloves? Spirits of turpentine with spirits of wine, will answer as far as cleaning goes, but the smell is disagreeable, unless the turpentine can have the smell destroyed without destroying the cleansing properties?

P. C.

How the leads for ever-pointed pencils are made? Where can I get the best glasses for a

telescope, and about the expense of these focuses: $1\frac{7}{8}$ inch 3 ft. plano-convex; $2\frac{1}{2}$ inch, ditto; 2 inch, ditto; $1\frac{1}{2}$ inch, ditto?

Given any trapezium, A B C D, and if a force = to 16 pounds be applied to the line L O, it will require a force = to 31 pounds to move it about the point C, it being applied to the line F G. Now the force applied to the line L O, is = 30 pounds; the angle L O D, is a right one, and the distance, D a = 37; then what force must be applied to the line F G, to keep the two forces in equilibrium, when the angle B G L = 30°, and the distance, G C = 25? L. L.



Is there any rule by which I can curve a spring, which is of equal breadth and equal thickness throughout its length, in such a manner, that when the ends are pressed down, and it is brought into a straight line, it shall press equally

upon the board in every point between the ends? When I bend it to the segment of a circle, the greatest pressure is in two points half way from the centre to each end. Thus, at points 1, 2, is the greatest pressure when the spring is brought down. T. Z.

The best method in use for dissolving India-rubber, and the method of applying it? Likewise any composition of a similar elastic and water-proof nature, that will answer the same purpose as India rubber, but be prepared at a much cheaper rate? H. J.

How to regild picture frames? G. W.

TO CORRESPONDENTS.

J. A. T.—*We shall be glad to see the description of his model.*

John Potter, Wigan.—*The residence of Dr. Turnbull is in Russel Square, London. From our correspondent's account of his case, we entertain little doubt that, inveterate as it is, it will not resist the skilful management of the doctor; but, of course, he alone can speak with certainty. We are doing no more than justice, when we state on the best authority, viz., actual observation, a fact highly honourable to that gentleman's character, that every applicant, rich or poor, is received with equal kindness and attention.*

P. T. *will shortly find ample information on the subject of his inquiry, in an article which is now in preparation.*

Curioso.—*Diamonds are considered to be pure carbon; they may be dissolved, or, rather, dispersed by heat, and nothing whatever has been detected besides the carbon.*

L. L.—*We prefer the answers being sent with the questions, when they are intended only to elucidate points of mathematical science. Letter-balances constructed similarly to those used for weighing gold coin, are now in use; but in all cases it is necessary that the scale which contains the letter, should be suspended.*

G. W.—*Glass is dissolved by fluoric acid. It may be obtained at the chemists' shops in lead bottles.*

H. M.—*An hydraulic lamp, invented by MM. Gerard, brothers at Paris, was first published in this country in the "Mechanic and Chemist," Vol. III., No. 119, Dec. 15, 1838. The principle of this lamp is exactly the same as that of the fountain to which he refers, described in the "Saturday Magazine" for May, 1839. In the application of this most admirable invention to the production of a jet d'eau, a syringe or pump must be introduced, to bring the water back from the lower into the upper reservoir, as often as it becomes exhausted. The height of the upper surface above the lower one, should not be less than five or six feet, to produce a jet of sufficient force for a garden fountain.*

A. J. P.—*It is not in our power to forward the views of our correspondent. We should recommend him to apply at the offices of any of the railway companies now in operation.*

G. W.—*The method of using French polish shall be described in our next.*

W. W.'s *shorthand will appear as soon as the plate is ready.*

A Subscriber.—*Rancid oil, which, by its acidity, is injurious to fine machinery, may be purified by heating it with calcined magnesia. Animal oil is found to be preferable to vegetable. We refer our correspondent to No. 52, Vol. II., of the "Mechanic," for farther information.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand: and may be had of all Booksellers and Newsmen in Town and Country.

THE

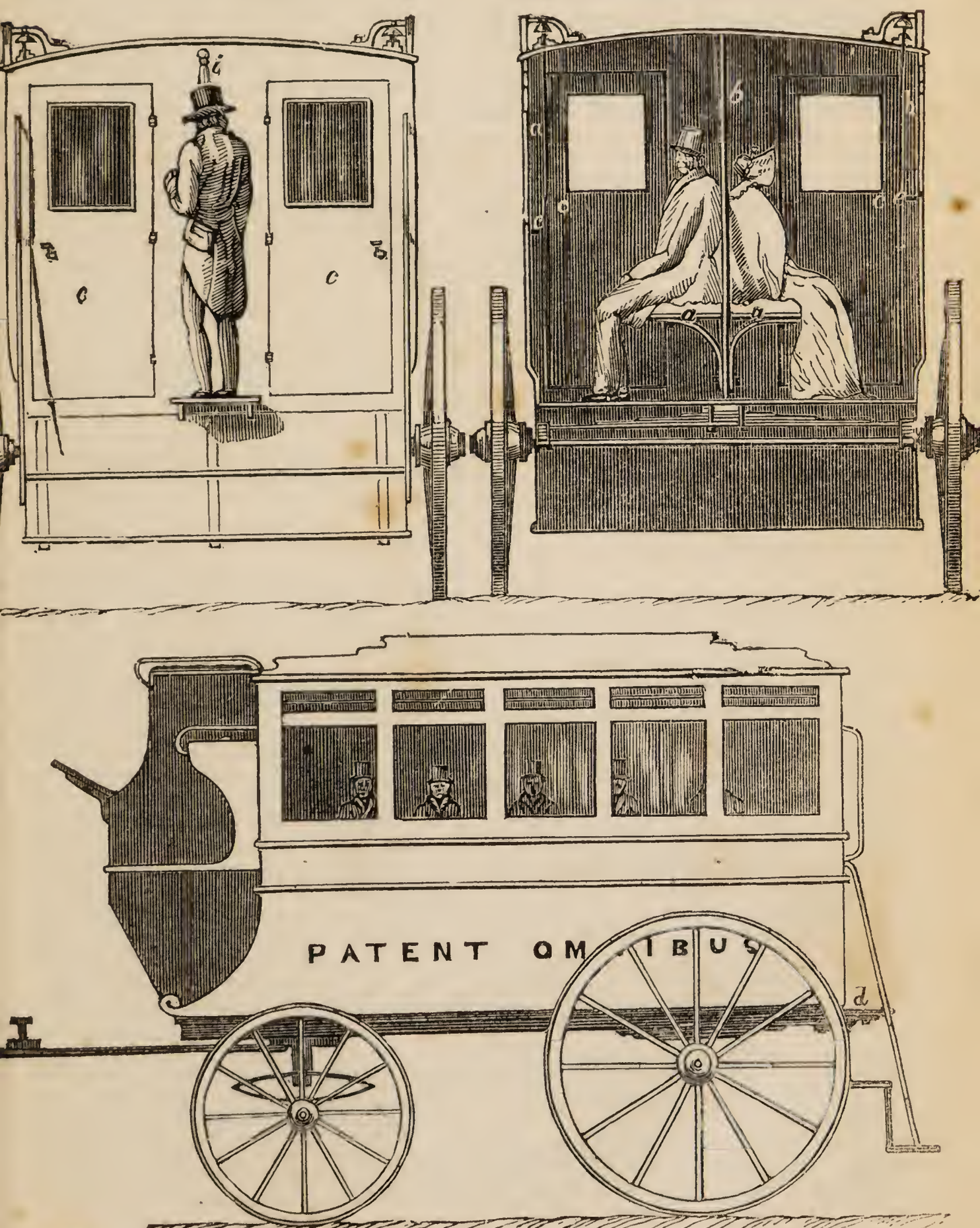
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 89, NEW SERIES. } SATURDAY, APRIL 25, 1840. PRICE ONE PENNY. { No. 210, OLD SERIES.

THE PATENT OMNIBUS.

FIG. 1. FIG. 2.



Vol. V.—No. 4] City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

NEW PATENT OMNIBUS.

"It must be admitted that among the numerous improvements for the public accommodation which have been introduced during the last few years, none have received a greater share of patronage than the omnibus, in consequence of the great economy it effects both in time and money; and although in the earlier period of introduction, that vehicle had to contend with considerable prejudice, it is now generally encouraged and supported. But while competition has done much to improve the common omnibus in appearance and comfort, there remain extreme defects in its construction and use, which the patent omnibus will effectually remove.

One of the chief objections to the common omnibus, is the great inconvenience experienced in passing to and from the seats; for upon the slightest movement of the vehicle, a passenger may be jolted against the nearest parties, and perhaps thrown down before he can take his seat; this is an objection very constantly felt and acknowledged, and, where ladies are the sufferers, is infinitely more annoying, and sometimes dangerous. To obviate this inconvenience, the patent omnibus is divided into two compartments, by a partition along the centre, and having a row of seats on each side, against the partition, facing the windows; ample room being given for passengers to take their seats. The compartments or sides are entered by distinct doors, and, under the windows, rails are fixed for the use of passengers, so that ladies, invalids, and elderly persons, can easily guide themselves to or from the vacant places.

The difficulty of ventilation hitherto experienced, is obviated with equal certainty and security. In the common omnibus, if the windows be opened, the passengers who are sitting with their backs to them, run the risk of catching cold; this is necessarily the same on both sides of the vehicle, and thus the windows are seldom opened at all. The offensive effluvia arising from want of ventilation in wet or hot weather, is not only exceedingly disagreeable, but also tends to induce headache, faintness, and other ailments. But, from the peculiar construction of the patent omnibus, the passengers face the windows, by which admirable arrangement any degree of ventilation may be kept up without the slightest inconvenience resulting.

There is no doubt that the impunity with which robberies are effected in the common omnibus, may, in a great measure, be attributed to the confusion that occurs while passengers are entering or leaving it, and who have to thread their way, with the greatest difficulty, between the feet and legs of those who are seated; robberies being with more facility effected from the crowding that must occur, when passengers are packed together *vis à vis*, and from the general exclusion of light. In the patent omnibus this evil is fully and effectually remedied; while the better and more certain distribution of light affords a more immediate detection of theft, should it be attempted.

Other improvements are made, among which, and within reach of every passenger, is a check or signal communicating with bells, to indicate the side of the street at which any passenger may desire to be set down, without the necessity of calling out to the conductor; and equal care is taken to afford protection to the passenger in getting on and off the steps, which extend so as to prevent the necessity of stepping into the carriage-way or centre of the street."

The foregoing description is in the inventer's own words; the model is deposited for public inspection, at No. 84, Lombard Street.

It cannot be denied that much inconvenience is experienced by passengers in the omnibuses as at present constructed; and we also admit that much of that inconvenience is obviated by the arrangements adopted in the patent omnibus; but, unless the carriage be made inconveniently broad, there cannot be sufficient space for a tall person to sit in a very easy posture; and it is proposed that the additional width shall be only six inches. There is another objection, of a more serious nature, and which, in the estimation of many persons, will more than counterbalance all the advantages set forth by the projector:—the passenger can only see one side of the road; this will be a great disappointment to those who desire to observe the different objects as they pass, and, moreover, a great impediment to the recognition of the particular spot at which a person may wish to descend, when the place assigned to him in the carriage happens to be on the wrong side. We advise the patentee to seek a remedy for this great inconvenience, before he brings his omnibuses into public competition on the roads. The idea of windows in the partition must immediately suggest itself; but to what extent such arrangement would obviate the evil, and what obstacles may be opposed to its execution, we must leave for the inventer to determine.

DESCRIPTION.—Fig. 1 is a back view of an omnibus constructed according to the invention; fig. 2 is a transverse section of the same; fig. 3 is a side view of the omnibus. *a a* are passengers' seats affixed in the centre of the omnibus; *b* is a partition dividing the omnibus into two compartments; *c c* are two doors which hang clear away from the wheels; *d* is the conductor's step between the two doors; *e e* are two strong hand-rails affixed on the sides of the omnibus, by which passengers are aided in passing from one end of the omnibus to the other; *f f* are bells, to give notice to the conductor; *h h* are check-cords within reach of all the passengers, when desirous of communicating with the conductor; *i* is a handle for the conductor to hold by, when on his step.

MACHINERY FOR COMMUNICATING UNIFORM MOVEMENT TO EQUATOREALS.

A COMMUNICATION has been read to the Astronomical Society, "On the Regulator of the Clock-work for effecting Uniform Movement of Equatoreals," by G. B. Airy, Esq., Astronomer Royal. The author describes the various means which have hitherto been adopted for obtaining a steady and equal motion, none of which have succeeded with the desired degree of accuracy.

"In the mountings constructed by Fraunhofer, the axis of the regulator is vertical; it carries a horizontal cross-arm, to the extremities of which are attached springs, nearly transverse in direction to the cross-arm, carrying at the ends small weights. When the regulator is made to revolve with a certain velocity, the centrifugal force of the balls bends the springs, till the balls just touch the inner surface of a drum which surrounds the regulator. The smallest additional velocity causes the balls to press against the drum, and create a friction, which immediately reduces the velocity; and the drum is made slightly conical, so that, by raising or depressing it, the velocity may be altered at pleasure. This construction not only partakes of the defects common to all the others, but is liable, besides, to this peculiar objection, that the determinate rate will depend most essentially on the strength of the springs, and will, therefore, depend on temperature and other varying causes. The other constructions (which were practically introduced by Mr. Sheepshanks) depend upon the same principle as that of the governor of the steam-engine. Two balls suspended from the upper part of a vertical axis by rods of a certain length, are made to expand by the rotatory velocity of the axis; and this expansion, when it reaches a certain extent, is made to press a lever against some revolving part, and thereby to create a friction, which immediately checks the velocity. In some cases, the balls are suspended by rods from the extremities of a horizontal arm, carried by the vertical axis. This construction, adopted in the south equatoreal of the Royal Observatory, may be considered analogous to Fraunhofer's, substituting for the springs the gravity of the balls—a change which can hardly fail to be advantageous. Now, the uniformity of rotatory motion of the spindle, in these various constructions, depends entirely on this assumption:—that if, upon the whole, the retarding forces are equal to the accelerating forces, the revolving balls will move in a circle, and in no other curve. But this assumption is not correct. If, for instance, we consider the case of balls, suspended as in the governor of the steam-engine; the motion of each of the balls may be the same (omitting the moments of inertia of the various parts of the machine, which are trifling) as that of a ball, suspended by a string, and put in motion by an arbitrary impulse; and a ball, so suspended, may move in a curve differing insensibly from an ellipse. Now, this elliptic motion actually takes place. In some instances, observed by the author, the balls of the regulator, instead of revolving in a circle, revolved in an ellipse of considerable eccentricity, and the rotatory motion of the spindle was, therefore, exceedingly variable. The effect of this irregularity on the motion of the equatoreal, whether the inequalities of motion are followed by the polar axis, or merely communicate a general tremor to the frame, must be injurious. The inequality now mentioned, is only one case of a very extensive theorem, which may be thus enunciated:—'Whenever the equilibrium of forces requires that a free body be brought to a determinate position, either absolute or relative to other parts of the mechanism with which it may be connected, the body will not remain steadily in that position of equilibrium, but will oscillate on both sides of that position, and (so far as the action of those forces affects it) will have no tendency to settle itself in the position of equilibrium.' This theorem supposes that some cause of disturbance has once put the body into a state of oscillation, and renders it necessary to take account of such oscillation in planning any mechanism which depends upon assuming the

position of equilibrium to be nearly preserved. If we examine the theory of the regulator, we shall see that the friction, which checks the motion, takes place when the balls are most distant from the axis, and (as the equable description of areas is nearly observed) this occurs when the angular motion is least. The whole maintaining force acts without check, when the balls are nearest to the axis, that is, when the angular motion is greatest. Therefore, when the angular motion is least, the acting forces tend still to diminish it; when greatest, they tend to increase it. Hence the inequalities of angular motion will increase till some new forces come into play, which act in some different manner: and thus is explained the obstinate adherence of the governor balls, in some cases, to their elliptic motion. The author next proceeds to consider the ways in which an attempt may be made to counteract the injurious effects of such oscillations. These appear to be only two: one, to make the oscillations of velocity much slower (or to make their periodic time longer); the other, to make the oscillations quicker (or to make their periodic time shorter). The first of these methods has the effect of giving greater smoothness to the motion (an object of great importance); and it is the principle which was adopted with success in the clock-work of the Cambridge equatoreal. The second method endangers the smoothness of the motion; but, as the error has but a short time for accumulation, it insures that the object shall remain steady under the view of the telescope, far more completely than the first. The construction attached to the clock-work of the south equatoreal of the Royal Observatory, is on this principle; and it appears to answer well. The mathematical problem proposed by the author in the present communication, is an investigation into the motion of governor balls, for the purpose of deducing the time of rotation corresponding to a given expansion of the balls, and the periodic time of their oscillations, and the consequent oscillations in the angular speed of the spindle."

This subject is discussed with the skill which might be expected from the learned author; but it still remains to discover a means of effecting a motion which shall unite the two great requisites, uniform progression, and the absence of vibration, or tremulous motion in the machine. It is a question which may come within the grasp of every machinist, as no astronomical knowledge is required; it is only necessary to consider a heavy body to revolve uniformly at the rate of one revolution in twenty-four hours. The vibrations of a pendulum, as in a common clock, will not produce the required effect, because the motion would be intermitting; nor is the expanding fly entirely satisfactory, for reasons before stated. We, therefore, advise our mechanical readers to exercise their skill in seeking some contrivance which may supersede those above described.

ON ELECTRICITY.

NO. III.

(*Continued from page* 298.)

Upon the principle of electrical attraction and repulsion, we construct instruments termed electroscopes, for the purpose of enabling us distinctly to perceive these phenomena, and to detect the presence of electricity in a body, when it exists only in a slight degree. By them we can also discover, whether this electricity is in the negative or positive state. Instruments which enable us to measure the intensity or quantity of this fluid there is in a body, are termed electrometers.

A very good electroscope, for common purposes, is represented in the annexed figure.

Fig. 1.

It consists of a glass handle, to the extremity of which is attached a brass knob, from which is suspended, by means of two thin silver wires, or hempen threads—previously macerated in a saturated solution of common salt, and then dried—two balls, about the size of a pea, made either of cork or the pith of elder. When the brass knob is brought into contact with an electrified body, its electricity is communicated to the pith balls, which, being thus similarly electrified, immediately repel each other, and diverge. This is, of course, proportioned to the strength of the charge; if there is a small quantity of electricity, they will diverge but little,

and *vice versâ*. Now, if we wish to know whether this electricity is in the negative or positive state, we have only to bring a tube of glass, excited by silk, in contact with the brass knob. If the pith balls are repelled farther, we shall conclude that they are charged with positive electricity; but if they contract, and all electrical appearances cease, with negative. A stick of sealing-wax, excited by flannel, will answer equally well as the glass; but, then, the phenomena observed will necessarily be the reverse of the above.

Fig. 3.

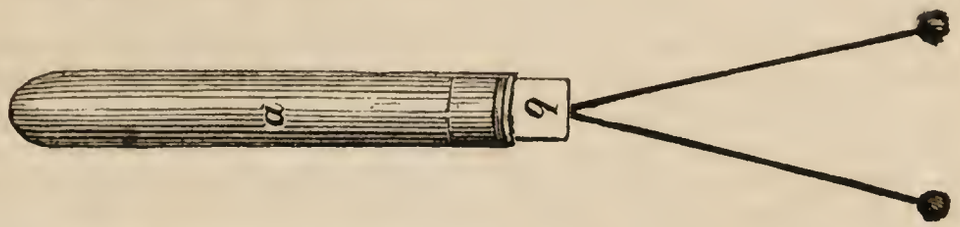
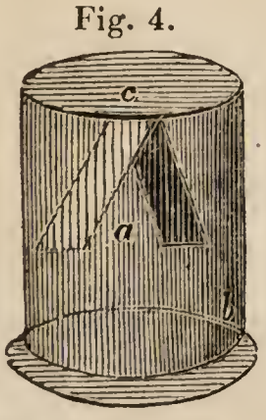


Fig. 2.

An electroscope, contrived by Cavallo, is here represented; it acts in precisely a similar manner to the one we have just mentioned, but is rather differently constructed, and far more portable; *a*, fig. 3, is a tube of polished glass,* rounded at one end, and open at the other, into which a cork, *b*, is fitted, and from which the pith balls are suspended. No farther description is required. When the instrument is not in use, the cork can be reversed, as in fig. 2, and the instrument placed in the pocket.

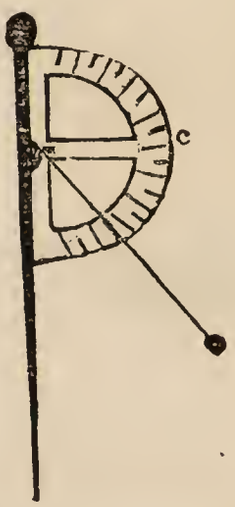
Where great delicacy, however, is required, an instrument has been contrived by Mr. Bennett, which is termed the gold-leaf electrometer.† It consists of two narrow slips of gold leaf, *a*, fig. 4, which are suspended in a glass cylinder, *c*, to secure them from disturbance by accidental currents of air; when a minute charge of electricity is communicated to the cap, *c*, of this instrument, which communicates to the leaves, they will immediately diverge to an extent proportioned to the strength of the charge.

Fig. 4.



The following instrument enables us to measure the intensity or amount of electricity there is in a body, when collected together. It does not pretend to any great accuracy, but is useful to discover the gross amount of the charge of a Leyden vial, battery, &c It also acts on the principle of the repulsion of bodies when similarly electrified, and is termed the quadrant electrometer. It consists of a

Fig. 5.



round metallic rod, *a*; to the upper extremity of which is fixed a brass ball, *b*. The semicircle of metal, *c*, faced with ivory, divided into 180°, is attached to this rod, from which is suspended, at a point corresponding with the centre of the semicircle, a very thin piece of wood or cane, terminating in a pith ball, *d*, which serves as an index. This hangs perpendicularly when not electrified; but, as soon as a charge of electricity is communicated, it immediately begins to diverge, traversing the semicircle, till it arrives at 90°, when the jar, battery, or whatever it communicates with, may be considered as loaded. The metallic rod, *a*, is fixed in one of the holes on the upper surface of the conductor, when the electrometer is in use.

When we excite an electric, other phe-

* I have heard of one being made with a common vial, which answered very well.

† In fact, only an electroscope.

nomena, besides those of attraction and repulsion, will be observed, if it be of sufficient size. Flashes of light, attended with a snapping sound, will fly off into the surrounding air; and, if the knuckle be presented to any part of the surface, a spark will pass from it to the knuckle, and a pricking sensation will be felt. When the excitation has been continued for some little time, a strong sulphurous smell has generally been found to attend it. From the above we may learn, that the passage of the electric fluid, under some circumstances, is attended with light, and it may be set down as a general rule, that this is always the case when its passage from one conductor to another is impeded by the intervention of imperfect conducting bodies; or, in other words, when there are obstacles in its path. When, however, the electric fluid passes through a perfect conductor, it is unattended with light; for instance, atmospheric air is an imperfect conductor; in fact, when dry, a remarkably good insulator, and when a spark is taken through it, by bringing a brass ball within an inch or two of the conductor of the electrical machine, light is observed. Various have been the opinions as to the cause of this light.

It was believed by the early electricians, that, when the electric fluid had arrived at a certain degree of accumulation, it was itself luminous; but the moderns, in general, hold a different opinion, and, certainly, a more philosophical one; and, without stating at present whether we agree with them or not, we shall here give them. They say, it is well known that, when air is suddenly and violently compressed, it will appear luminous. Now it may reasonably be expected, that the electric fluid exerts a very sudden and powerful pressure upon the air in its passage through that resisting medium; and we are certainly justified in presuming, that the same phenomena proceed in both cases from the same cause. Biot, Professor Brande, and others, have adopted this opinion.

There are some curious and interesting experiments which illustrate the fact, that electrical light is only observed when its passage from one conductor to another is impeded by the intervention of imperfect conducting bodies. Take a glass tube, open at each end, and paste small fragments of tin-foil upon the inside of it, at a short distance from each other in a spiral direction; let a brass ball be attached to one end, and a handle to the other: take the handle in your hand, and bring it to the conductor of this machine when in action, as in the following figure:—

Fig. 6.

A communication is thus made between the conductor and the ground; and such is the rapidity* with which the electric fluid passes, that if the experiment be performed in the dark, the whole spiral will appear luminous at the same instant. Letters, words, and other devices can, in a similar manner, be illuminated, by pasting small spangles of tin-foil at a short distance from each other, upon a piece of glass, as in fig. 7, and bringing the ball, *a*, in contact with the conductor of the machine.

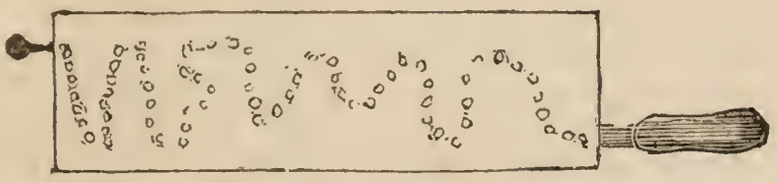
If one end of a chain be communicated with the prime conductor, while the other is held in the hand, it will, in the dark, appear luminous at every link.

The brilliancy of the electrical spark appears to depend upon the conducting power of the body through which it passes. When taken from an imperfect conductor, as wood, for instance, it has a faint red appearance; though brass or silver, which are good conductors, affords them of great brilliancy. Its colour, likewise, is subject to variation; it is not always the same,

* In an experiment made on Shooters Hill, to ascertain the velocity with which the electric fluid moves, it was made to perform a circuit of four miles, at a time that the ground was remarkably dry; being conducted for two miles along wires supported upon baked sticks, and for the remaining distance also, of two miles, through the dry ground. As far as could be ascertained by the most careful observation, the time in which the discharge was transmitted along that immense circuit, was perfectly instantaneous. Nor has any other trial that has yet been made, afforded the least approach to a measurement of the velocity with which electricity moves.

appearing, in a great measure, to depend upon the substance from which it is taken. Thus, if the electric fluid passes between two polished metallic surfaces, its colour is nearly white; but if the spark is received by the finger from such a surface, it will be violet. The sparks are green, when taken by the finger from a surface of sil-

Fig. 7.



vered leather; yellow, when taken from finely-powdered charcoal: and purple, when taken from the greater number of imperfect conductors.

When we wish to collect electricity in a conducting body, we insulate that body; or, in other words, cut off its communication with every other substance, by means of an electric, which, as we have before said, will not conduct electricity; thus, the prime conductor of the electrical machine is insulated by means of a glass leg, or the electricity would be dissipated as fast as it was collected. A person standing on a round board, with an electric intervening between him and the ground, is thereby insulated; and if a communication be made between him and the prime conductor of the machine, he will receive a superabundant supply of electricity, more than his natural quantity; in other words, he will be positively electrified, and sparks can be taken from any part of his body, in the same manner as they can from the conductor of the machine. If highly electrified, the hairs of the head will, being similarly electrified, mutually repel each other, and stand erect.

H. WIGLESWORTH.

The People's Letter-bag and Penny-post Companion, containing Forms of Letters written on Every-day Subjects, and adapted to the use of the Million. By WILLIAM WAVERTON. London: Darton and Clark.

WE have great pleasure in recording the success of this little manual. The second edition, which is now before us, is greatly enhanced in value by the addition of a judicious abstract of the Penny-postage Act, divested of all its legal technicalities and repetitions, but embracing every point of information that is necessary for all the purposes of home and foreign correspondence. It is a practically useful synopsis of the rules and regulations under the new Postage Act, conveyed to the public in a most desirable and agreeable manner.

Now that the postage of letters is reduced to such a trifle, and you can, as it were, shake hands with your distant relatives and friends for a penny, such a work as "The People's Letter-bag" is an aid that will be appreciated by hundreds and thousands of that class of the community, whose epistolary communications prior to the reduction in postage, were, indeed, "few and far between." The formidable expense of a letter, which had to travel 200 or 300 miles, was a barrier to anything like a regular interchange of sentiments among the humbler orders of society. Letter-writing, consequently, is to those persons a very unfamiliar kind of exercise. They will, however, find "The People's Letter-bag" an able auxiliary adapted to all circumstances and occasions. There is most ample supply, indeed there is scarcely any subject of a general or domestic character, that is not included in this *multum in parvo*; and no demand for assistance in communicating any of the incidents and circumstances that attach to ordinary life, is likely to occur, that may not here be satisfied. A work of this kind, which tends so materially to augment the social comforts and enjoyments of the working classes, is deserving of a large circulation, and we heartily wish it success.

DALE READING SOCIETY.

To the Editor of the Mechanic and Chemist.

SIR,—It is with pleasure that I read in the "Mechanic and Chemist," that mechanical and chemical societies are increasing; and, no doubt, the information I am about to give will be received with pleasure. We have a Society here, consisting of upwards of twenty members, called the Dale Reading Society. We have lately introduced voluntary lectures, and find them to answer well during the last quarter. We have had seven lectures on va-

rious subjects, as mechanics, cutlery, botany, &c.; and there are several more in preparation, both on mechanics and chemistry. We take in several periodicals, among which is the "Mechanic and Chemist." I find that the plan of voluntary lecturing succeeds better than the old rule of each member reading or lecturing in his turn; for I found, that the former rule prevented many from joining, and several in the Society objected to it; as, having underrated their abilities, they considered themselves incompetent for the task, and preferred being taught, rather than teaching, at present. Our present plan of lecturing has warmed some of them; for those whom we did not expect, have given us lectures deserving of credit, not only for the way in which they were delivered, but likewise for the trouble in getting them up.

I hope we shall succeed in our exertions, and increase until a Mechanics' Institution is founded on a firm foundation in Coalbrook Dale.

I remain thine, respectfully,

JOHN CHILD, Sec.

Coalbrook Dale, Salop.

[We are much gratified to find that societies, so instructive and eminently moralizing as the one above described, are rapidly spreading over the country. It is our desire to do all in our power to promote their success; and we think that object might be attained, and, at the same time, useful information spread abroad, by publishing some of the interesting communications which, it may be anticipated, such societies will occasionally receive.—ED.]

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 29, Dr. Epps, on Phrenology. Friday, May 1, Charles Wood, Jun., Esq., on Spain. At half-past eight precisely.

Poplar Institution, East India Road. Tuesday, April 28, S. C. Horry, Esq., on Trial by Jury. At eight o'clock precisely.

QUERIES.

An inextensible string binds tightly together two smooth cylinders, whose radii are given; what is the length of the string, and the ratio of the mutual pressure between the cylinders to the tension by which it is produced? P. A.

A body is projected in a medium whose resistance $= k$ (velocity) ^{n}, and is acted on by no extraneous force; what will be the whole space described, and the whole time of motion for all values of n? P. AMER.

TO CORRESPONDENTS.

NOTICE.—*Preparing for publication, a beautiful Engraving on copper of the Great Western Steam-ship. The above Plate will be given to every purchaser of the Index to Vol. V. of the "Mechanic and Chemist," which will appear in a week or two, the present being the closing Number of that Volume.*

E. L.—*The method of tempering springs has been fully explained in the "Mechanic;" and it is known to every steel-worker in the kingdom.*

A. Hodge's *garden pots are deficient in two material points—utility and ornament His invention is not, as he surmises, of* too delicate a nature for insertion, *but too inferior to those in common use. His manuscripts and drawings shall be returned in the manner he desires.*

P. Amer.—*We shall be glad to receive his abstract of Mr. Coombe's lecture on the effects of machinery on the working classes. We avail ourselves of the interesting papers he has favoured us with, excepting only that on electricity, which subject he will find treated in a series of papers, with minute and practical explanations, which will be found especially valuable to the amateur experimentalist.*

A Correspondent *will find the process of making fluoric acid in a recent Number of the "Mechanic," in a paper on acids by our much-valued correspondent, "J. Mitchell."*

P. P.—*We have received his model, &c., which will be left for him at the "Mechanic" Office, Long Lane, with our opinion. He will please to send his signature, to prevent mistake.*

G., a Consumer, *in our next.*

GRANT'S LONDON JOURNAL,

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THE Number of GRANT'S LONDON JOURNAL, conducted by the Author of "Random Recollections," "The Great Metropolis," &c. &c., which will appear on Saturday, May 2nd, Price Twopence, will contain the first of a Series of Articles on

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